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ABSTRACT

A framework of concepts in nutrition, environmental factors, genetics, and human growth and development is presented as a background for developing elementary and secondary curricula on responsible childbearing. Aspects of the four subject areas are outlined for instruction at five education levels: preschool through kindergarten, primary, upper elementary, middle/junior high, and senior high. Each of the subject areas is discussed in relation to goals and key concepts. The key concepts covered in the chapter on nutrition include the importance of nutrition for everyone and especially for pregnant women, food preparation methods, and eating habits. Those concepts discussed in relation to environment are the dangers of drugs and chemicals, infectious diseases, pollution, radiation, and the baby's delivery process. The concepts in the chapter on genetics include heredity and environment, and the causes and consequences of genetic disorders and birth defects. The chapter on human growth and development discusses developmental stages and the physical, emotional, and intellectual needs that affect human behavior and health. In the discussions of each topic, information is suggested as a basis for class discussion and instructional development. Each chapter is followed by a list of references. Charts indicate the recommended education level for teaching the key concepts. A final essay endorses the idea of action on the local level to make courses on responsible childbearing a part of the school curriculum. (FG)

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Educators' Challenge:

HEALTHY MOTHERS, HEALTHY BABIES

A Framework for Curriculum Development in Responsible Childbearing, Pre-school through High School

Compiled and written by
Dorothy Dolph Zeyen

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Foreword

In the summer of 1979, ASCD and the March of Dimes Birth Defects Foundation co-sponsored an Institute on Education for Responsible Childbearing. At this meeting, representatives of 50 major metropolitan school districts expressed their recognition and deep concern about the problems of adolescent pregnancy and the incidence of physical and mental birth defects occurring in babies born to adolescent mothers; dangers such births create for the young mother's health and survival; as well as the social and economic consequences such births have on individuals, families, schools, and communities. This concern was extended to prospective parents of any age by the Surgeon General's challenge to the nation to develop preventive programs in the areas of birth defects and infant mortality for emphasis during the 1980s (2). In response to those concerns, ASCD and the March of Dimes Birth Defects Foundation, through funds provided by the March of Dimes, have developed this framework of concepts in nutrition, environment, genetics, and human growth and development that affect decisions about responsible childbearing of healthy babies and mothers to be used by:

- Educators at the national, state, and local level as they assess existing programs and develop interdisciplinary curriculum that will fit into a variety of school subjects for children pre-school through high school.
- Agencies involved in health, education for parenthood, and related fields, to assess existing programs or to develop new ones.

Implementation charts for each chapter plus a sequence chart of all four subjects offer suggestions for developing these concepts at five educational levels: preschool/kindergarten, primary, elementary, middle school/junior high, and senior high.

Our focus is limited to concepts that apply to responsible decision making affecting a pregnant woman's health and the health and development of the fetus. Therefore, even though we recognize their importance, many aspects of education for parenthood are not necessarily included.

A "Basic" Educational Concern

Perhaps the most common denominator among children and young people in schools today is that they face the likelihood of one day choosing whether or not to become a parent, when, with whom, and under which economic, social, educational, and physical conditions. An overwhelming majority will one day become parents whether by deliberate choice or by chance. The ability to make these decisions in today's complex society is not easy nor is it inborn.

Since many birth defects can be prevented or minimized through proper nutrition, care in exposure to environmental factors, and knowledge about genetic influences, there can be no more basic education than that which provides the knowledge and skills to assist these prospective parents to make informed decisions about the conditions under which to have and care for as healthy a child as possible. Certainly this is not entirely the responsibility of the schools, but schools do have an important role to play (2).

Since parental health and behavior patterns have great influence on the development and health of their offspring, this education needs to begin as early in a child's life as possible while he or she is setting personal habits and attitudes, well before the critical time for deciding about becoming a parent. Therefore, both elementary and secondary schools have roles to play.

The Scope of the Problem

More than a quarter million—or one of every 12 infants—are born with physical and mental damage in the U.S. every year. Birth defects are the nation's most serious child health problem affecting the daily lives of people of all ages, races, and communities. About 1.2 million infants, children, and adults are hospitalized yearly for treatment of birth defects (4).

While many birth defects seriously affect newborn babies, other defects, if not diagnosed and treated immediately after birth or during the first year of life, can affect health and well-being in later years. Some genetically-transmitted disorders or disease susceptibilities may not appear until adulthood (such as heart disease, hypertension, arteriosclerosis, and diabetes) but their symptoms may be minimized or prevented through early habits of preventive nutrition and lifestyle practices.

Genetic diseases constitute a major health concern today. Twenty-five to thirty percent of patients admitted to pediatric services in teaching hospitals have diseases in whose origin genetics play a prominent part. Many

"Extremely low birth weight . . . is the cause of the greatest number of deaths in the first year of life and a leading factor in childhood disability."

genetic disorders can be predicted, diagnosed, treated, and prevented. Prospective parents can be alerted to risks before pregnancy through carrier identification and family histories. Affected fetuses can often be diagnosed in utero. For a number of metabolic diseases, diagnoses before or immediately after birth allow treatment that will prevent severe and permanent disabilities.

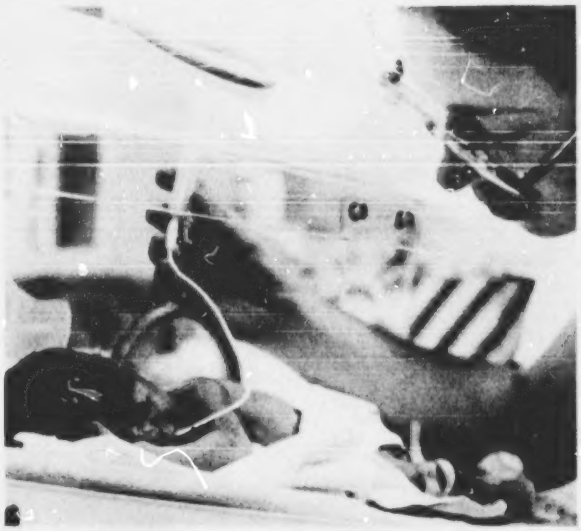
Within the past two decades immensely important discoveries have been made in the field of genetics and the relation of genotype to human diseases and disorders. Studying human genetics as they affect health should foster a sense of control as people begin to realize that they can intervene in the disease process in ways they had not imagined (3, 5).

For those defects that are caused mainly by environmental factors, prevention is often possible. Appropriate nutrition for the expectant mother, care in the use of medicines, drugs, alcohol, tobacco, and protection from diseases, radiation, and harmful chemicals can greatly reduce numbers of birth defects in infants (1, 2, 4).

Low Birth Weight

Low birth weight, while not a defect itself, is implicated in serious dangers to newborns. Of all infant deaths, two-thirds occur in those weighing less than 5.5 pounds (2500 grams) at birth. Infants below this weight are more than 20 times as likely to die within the first year. Extremely low birth weight (4 pounds 6 ounces or less) is the cause of the greatest number of deaths in the first year of life and a leading factor in childhood disability. The causes of low birth weight are complex, but several conditions are seriously implicated: the mother's age, lack of early and expert prenatal care, and combinations of lifestyle practices, including inadequate nutrition, smoking, use of drugs and alcohol, and other substances (6).

Mothers aged 15 and younger are two times more likely to have low birth weight babies than those aged 20-24. Among all teenagers, the risk is about 39 percent higher. Even mothers aged 19 have rates 27 percent higher than those who wait to give birth until they are in their early 20s. The causes are considered likely to be a result of a combination of age and lifestyle practices (6).



Early Prenatal Care

Early prenatal care is considered one of the critical determinants in a healthy outcome for both the mother and infant (1, 6). Given no prenatal care, an expectant mother is three times more likely to have a child with a low birth weight. Early prenatal care monitors the mother's nutrient needs, anticipates complications, and counsels about potential dangers.

By early prenatal care, we mean the first 8-12 weeks of pregnancy when the fetus is extremely vulnerable to harmful substances (such as teratogenic drugs and alcohol) and diseases, radiation and other factors. Those mothers most vulnerable to birth defects and low birth weight babies (adolescents and those with low socioeconomic status) are also the least likely to get early prenatal care (7).

Nutrition

Nutrition is a critical element in the healthy development of an unborn baby as well as the mother's health. The well-nourished mother at the time of conception has the best chance of providing the support her fetus needs to maintain her own health and have a normal delivery at birth. However, improved nutrition during pregnancy will have a marked influence on the weight of the baby. Since the child's father has a strong influence on the mother's food choices and lifestyle practices, boys as well as girls need education about nutrition and environmental factors that affect babies and mothers (2, 6).

Adolescent Pregnancies: A Serious Concern

It is evident that adolescent pregnancies result in a high

"The pregnancy rate in teenagers has been increasing steadily—by more than 100,000 per year since 1974. More than one in ten teenagers gets pregnant and the proportion is rising."

percentage of birth defects and dangers to maternal health. They also constitute social, economic, and educational stress that affects not only the adolescent and their at-risk babies but causes serious consequences to their families, as well as to education, health care and public assistance institutions, and society in general. The teenage birthrate in the U.S. is among the world's highest. Japan's birthrate is 1/18th as high and even developing countries of the Philippines, Malaysia, Singapore, and Tunisia have lower rates.

The pregnancy rate in teenagers has been increasing steadily—by more than 100,000 per year since 1974. More than one in ten teenagers gets pregnant and the proportion is rising. Sexual activity by teenagers increased by two-thirds during the 1970s. Twelve million teenagers, girls and boys, are sexually active. Alarmingly, 18 percent of boys and 6 percent of girls aged 13-14 have had sexual experiences and nearly half of the 15-17-year-old males and one-third of the females. Since one-fifth of the teenage premarital pregnancies occur in the first month of sexual activity and one-half of the pregnancies occur in the first six months, preventive education should begin at an earlier age than most schools, agencies, and families tend to provide. This recent increase in sexual activity is accounted for almost entirely by unmarried white adolescents indicating that no population group or community can consider itself immune to this increase in teenage premarital sexual activity and the resulting pregnancies.

Besides the emotional and psychological impact of early pregnancies on the babies, consequences of teenage pregnancies and births are economically costly to many institutions including education. For example, children with birth defects must be educated, often in special classes or facilities.Schools are also required to provide education for pregnant teenagers. In spite of this opportunity, the majority of teenage parents, especially young mothers, never finish high school. Poor education is one factor in teenage parents having low-paying jobs and low socioeconomic status, often for a lifetime. Young teenage mothers have 50 percent more births than those who begin parenthood later and their children are more likely to become teen parents themselves. The teenagers and their families may be hurt, and society's institutions carry the economic burden of these conditions (7).

The Role of the Schools

Since being informed does not necessarily lead to appropriate behavior, no simple solutions will affect the complicated reasons for and consequences of early sexual activity that results in teenage pregnancies and births or for helping all young people develop healthful behavior and responsibility for their own health and that of their children.

Many aspects of the behavior of prospective parents of any age are rooted in family, peer, cultural, and religious backgrounds and will reflect those value systems. These groups share the responsibility for influencing young people to establish positive and healthful behavior. However, except for family influence, the schools are most likely to reach young people and their families during the years when young people are establishing lifestyle habits. Certainly, as leaders in their local communities, educators have a challenge with the opportunity to reach out to educate the families of their students as well as the students themselves (2). The share of responsibility that schools may reasonably be expected to assume in these areas is suggested in this booklet.

Implementation

Curriculum developers may be reassured to realize they probably have base programs in various subject areas into which concepts of this framework can be inserted without major additions or changes. Some aspects of nutrition, environmental hazards, genetics, and human

growth and development may be part of health, science, home economics, physical education, family life or sex education classes, and even the social sciences, perhaps in elementary as well as secondary grades. Instructional lessons can be inserted to point out the relevance of these existing topics to the prevention of birth defects and health of babies and mothers.

Rarely, however, will textbooks in these subjects identify this relationship. Even in biology texts, few include human genetics as it relates to personal and social application to health (8). Therefore, curriculum will have to be developed. Whether it is designed to be taught as a separate unit or infused into the regular curriculum, educators may want to consider the following suggestions:

- These concepts should reach *all* young people and not just those who attend special or elective classes. There is a concern, too, that educators may view these concepts as relating only to sex education type classes for adolescent students. Although some concepts do relate directly to sexual maturation, most are appropriate for a broad array of subjects. There are plentiful opportunities at every school level and in many subject areas for inserting instruction in nonthreatening and noncontroversial ways acceptable to the value structure of most communities.
- Each concept may be developed in a spiral: (1) to establish awareness in very young children; (2) build knowledge of specific content at critical ages; (3) expand and apply this knowledge to increasingly more mature decisions in succeeding years. "Too little, too late" is a hazard to the success of our goals. Since attitudes and behavior patterns develop early, so must awareness, knowledge, and practice with responsibility and decision making begin early.
- In order to illustrate the human impact and personal and social consequences of these topics, the concepts need to be developed across a number of subject areas. To teach the science without the social application removes its relevance to human decisions and behavior.
- Teachers and administrators may need help in developing knowledge and sensitivity about the importance of and instructional methods for including these concepts. Generally teachers feel a responsibility to teach those subjects the district and the school administrator feel are important and for which both the teacher and student are held responsible. Involvement in developing curriculum and special training not only increases a teacher's ability to handle the subjects well, but also increases appreciation of the subject's importance. Content that is infused into existing curriculum can easily be slighted if there is no effort made to establish its importance.
- The degree to which the learner is involved in applying the information, making choices, and assessing consequences to situations that have meaning to personal life will influence the role this content will have on the development of positive personal behavior. Therefore, students at each age level need to make decisions, participate in personal assessment of health practices, and assume reasonable responsibility appropriate for their age.
- You must have a system for coordinating these concepts among the various subject areas to eliminate overlap or exclusion of content and to ensure that most students receive the instruction.

The content for which there is no assessment can easily disappear. When content crosses subject level boundaries, there may be no person or department responsible for checking on implementation, especially at the secondary level. Some designation of responsibility for implementing the curriculum concepts is essential. Guidelines and curriculum alone will not reduce health problems for mothers and babies.

Educator's Challenge

To allow avoidable or preventable defects to occur to a new life because of lack of education is a price too high for individuals or a caring society to accept.

This text is dedicated to identifying those concepts of responsible childbearing that *every* young person should know. So that even now the potential parent will begin caring for personal health, practicing informed decision making about personal lifestyle, forming positive ways to meet physical, psychological, and emotional needs, and developing awareness of the kind of parent he or she wants to be.

The schools have a role to play in direct instruction. But also they have the opportunity to reach into the community to extend this education to families and institutions that influence young people. Healthy babies by healthy mothers is a worthwhile goal for every community.

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Nutrition Concept Chart.

The following chart keys into concepts expressed in the Nutrition chapter.

		Pre-school through Kinder-garten	Primary	Upper Elemen-tary	Middle/ Junior High	Senior High
KEY CONCEPT 1:	Nutrition is a major factor in development and health in living organisms.					
Focus 1:	The overall physical well-being of the woman prior to conception and during pregnancy will have an impact on the growth and development of the fetus.	Ⓐ	Ⓐ	●	○	○
Focus 2:	The nutritional status of the pregnant woman will profoundly influence the health and development of the fetus and will be a major influence on the degree to which its inherited potential is realized.	Ⓐ	Ⓐ	●	○	○
Focus 3:	Poor nutrition is often a factor in babies born with low birth weight; both conditions can be dangerous to the baby's survival and health.					
Focus 4:	Adequate nutrition during pregnancy is important for the mother's health, in particular the young adolescent pregnant woman.			Ⓐ	●	○
Focus 5:	Early and regular medical care is essential in every pregnancy and significantly increases the likelihood of full weight, healthy babies.	Ⓐ	Ⓐ	Ⓐ	●	○
Focus 6:	The newborn infant requires nutrition appropriate to an immature digestive system and adequate to support the rapid body growth of the first year.	Ⓐ	Ⓐ	●	○	○
KEY CONCEPT 2:	The pregnant woman and her fetus receive the nutrition their bodies need from nutrients—all are essential and each has a specific function in the body.					
Focus 1:	Appropriate amounts of protein, carbohydrates, fats, and water are necessary for the growth energy of the pregnant woman and her baby.		Ⓐ	●	○	○

KEY TO SYMBOLS:

Ⓐ—Awareness. Concept can be introduced (with limited and appropriate examples) as it relates to science, social studies, or general observation of the human condition, and so on without going into the details of the content.

●—Concept can be expanded with enough detail to clarify cause and effect and the role this information plays in each person's life.

○—In-depth instruction of concepts taught at previous levels with expanded decision making, assessment of social impact, application to real problems.

Nutrition Concept Chart (continued)		Pre-school through Kinder-garten	Primary	Upper Elemen-tary	Middle/ Junior High	Senior High
Focus 2:	Vitamins and minerals are essential to body functions and may need to be monitored by a medical advisor during pregnancy.			Ⓐ	●	○
Focus 3:	Foods can be grouped by nutrient content to assist the pregnant woman in developing food plans and evaluating food and diet fads.		Ⓐ	●	○	○
KEY CONCEPT 3:	The way food is handled can change the nutrient content.					
Focus 1:	Methods of preparation and cooking change nutrient and calorie content.	Ⓐ	Ⓐ	●	○	○
Focus 2:	Commercially processed, precooked, or "convenience" foods may have chemicals added to preserve them, enhance color, or improve nutrient levels. These may alter nutrient content and affect health.		Ⓐ	Ⓐ	●	○
Focus 3:	Skill in reading labels on food packages is essential to determine nutrient content in processed foods.		Ⓐ	●	○	○
KEY CONCEPT 4:	Food choices are influenced by social, psychological, cultural, and economic factors.					
Focus 1:	Pregnant women are often influenced in their food choices by the father of their child, as well as other family and social contacts.	Ⓐ	Ⓐ	●	○	○
Focus 2:	Food choices can be nutritious and still allow for ethnic, cultural, and personal food preferences.			Ⓐ	●	○
Focus 3:	There are skills and resources to help a pregnant woman meet economic restrictions that affect nutrition.				Ⓐ	●
Focus 4:	Commercial food industries, through their advertisements and display techniques, exert great influence on food choices.		Ⓐ	Ⓐ	●	○

KEY TO SYMBOLS:

Ⓐ—Awareness. Concept can be introduced (with limited and appropriate examples) as it relates to science, social studies, or general observation of the human condition, and so on, without going into the details of the content.

●—Concept can be expanded with enough detail to clarify cause and effect and the role this information plays in each person's life.

○—In-depth instruction of concepts taught at previous levels with expanded decision making, assessment of social impact, application to real problems.

Nutrition

Goal: To understand the effects that nutrition has on the outcome of pregnancy for the mother and child.

Key Concept 1: Nutrition is a major factor in development and health in living organisms.

Focus 1: The overall physical well-being of the woman prior to conception and during pregnancy will have an impact on the growth and development of the fetus.

SUGGESTED INFORMATION:

• The healthy functioning of a person is dependent on the interaction and interdependence of all the cells, tissues, organs, and systems that form a human being. Therefore, anything that interferes with the functioning of any one organ within a system causes a lowering of efficiency in the total person. Those who hope one day to have a child should begin early in life to develop:

—A positive lifestyle that promotes adequate nutrition, exercise, and rest

—Freedom from disease

—Healthful methods for relieving stress

—Care in the exposure to social/medical drugs, chemicals, and other environmental factors that inhibit the efficient functioning of body systems (2).

Focus 2: The nutritional status of the pregnant woman will profoundly influence the health and development of the fetus and will be a major influence on the degree to which its inherited potential is realized.

SUGGESTED INFORMATION:

• At first the fetus receives the necessary nutrients from the thickened wall of the mother's uterus and thereafter from the mother's bloodstream mediated by the placenta. Nutrients and other substances influence whether organs develop and the amount they grow before birth.

• Adequate nutrition prior to conception and throughout pregnancy enhances the general well-being of the expectant mother, thus enabling her to provide adequate support and nutrition to the developing fetus (3, 20).

• Each organ and portion of the embryo develops during predictable time periods. Most birth defects are caused during the first 8-12 weeks of pregnancy when almost every organ of the fetus is formed and begins to grow. If this process is disturbed, the organ or portion will never fully or properly form.

Although extra nutrition is not necessary during this period, balanced nutrition and the mother's physical condition are critical. For instance, iron and folic acid, common nutrient deficiences in women, are vital to the formation and function of blood supply for the mother and fetus. Since it is sometimes difficult to obtain adequate supplies from food alone, supplements may be prescribed by a medical advisor.

• During the second and third trimesters, both the mother's body and the fetus experience a lot of growth. The mother needs an increased intake of nutrients—especially protein, calcium, iron, and folic acid—for fetal tissue, bone, and blood development. Great amounts of energy are also required, and energy foods should be adequate so that protein will not be diverted from tissue building. For example:

—Lack of adequate protein and calories during the last three months may affect the brain's greatest growth period.

—If calcium and phosphorous are inadequate during the last month when teeth and bones grow quickly, the fetus will sap the mother for its needs (1, 20, 17).

• Even though the pregnant woman has not been well-nourished before conception, a program designed to remedy her deficiencies in weight and health and to properly nourish the fetus can improve the chances for the infant to be well-developed and healthy (21).

Focus 3: Poor nutrition is often a factor in babies born with low birth weight; both conditions can be dangerous to the baby's survival and health.

SUGGESTED INFORMATION:

• In adolescent women, there is a greater likelihood of low birth weight (under 5 lbs., 6 oz.) in full-term babies, as well as a higher incidence of low weight premature births. The baby is deprived of fat that insulates for temperature changes and protects organs from injury. In premature babies, there is greater chance that organs, particularly lungs, are not completely developed

"Early and regular medical care is essential in every pregnancy and significantly increases the likelihood of full weight, healthy babies."

and incapable of functioning on their own. Because certain immune systems that develop during the last month may not be present, the chances of infection and illness after birth are increased.

Careful medical care will help some newborn infants live and further develop their body systems until normal birth weight is reached. In other cases, where development was imperfect or incomplete, physical and mental birth defects may be permanent (6).

- Nutrition is not the only cause of low birth weight in babies. Smoking, drugs, and other environmental factors are known to contribute to this condition. However, it has been shown that improved nutrition, even in the last one or two months of pregnancy, has increased birth weight in babies (2, 14, 15, 20).

Focus 4: Adequate nutrition during pregnancy is important for the health of the mother, in particular the young adolescent pregnant woman.

SUGGESTED INFORMATION:

- Adolescent women who become pregnant, especially those who are within the first few years of beginning menstruation, must be particularly concerned about nutrition, since they will need many nutrients for the growth of their own bodies as well as those of their babies. If nutrition is inadequate, nutrients will be directed from the mother's body to satisfy the baby's needs.

The average teenager who is pregnant will need as much as 25 percent (between 300-600 calories) more in her diet, especially during the last six months. This can be added with an extra glass of milk and a sandwich or larger amounts of foods ordinarily eaten (1).

- Although recommendations vary among nutritionists and doctors, a gradual gain of 20-28 pounds may be recommended during pregnancy to allow for the growth in the mother's body and for the fetus, placenta, and amniotic fluid.* If the pregnant woman is underweight at the beginning of pregnancy, the doctor may recommend an even larger weight gain. Contrary to past beliefs, this extra weight gain does not result in difficult births or overweight babies and the mother can return to normal weight within a few months after delivery. Dieting to lose weight during pregnancy is not recommended (2, 13).
- Sudden gain or loss of a lot of weight may indicate problems and should be checked by the doctor.
- A two-year period between pregnancies allows the mother's body to regain any nutrient deficiencies caused by pregnancy and birth. Women who have several pregnancies within a short period of time risk being nutrient deficient and will need special supplements as recommended by a medical advisor (2).

Focus 5: Early and regular medical care is essential in every pregnancy and significantly increases the likelihood of full weight, healthy babies.

*The American College of Obstetricians and Gynecologists. *Assessment of Maternal Nutrition.* Chicago: 1978.

SUGGESTED INFORMATION:

• During pregnancy nutritional needs and other physical problems may not be obvious to a lay person. The doctor or clinic can keep track of the chemical balance in the mother's body and observe symptoms of nutritional deficiencies or disease that the lay person may overlook. Not every woman responds to pregnancy in the same way and the response may differ with each pregnancy. The nutritional needs of each woman will vary according to maternal age, general conditions of health and weight, and eating patterns. Regular medical observation provides the pregnant woman and medical advisor with opportunities to work together for a positive outcome for each pregnancy.

• Since the first 8-12 weeks are the most critical to development of the fetus, medical care by a private physician or prenatal clinic should begin as soon after conception as possible. A woman who anticipates becoming pregnant can have an examination and consultation before conception to promote a healthy environment for herself and her baby (14, 15).

Focus 6: The newborn infant requires nutrition appropriate to an immature digestive system and adequate to support the rapid body growth of the first year.

SUGGESTED INFORMATION:

• Generally healthy full-term infants benefit from breastfeeding unless there are special problems. The nutrients in human breast milk tend to be digested and absorbed more easily than cow's milk. In addition, breast milk may serve to transfer immunity to some diseases from the mother to the infant. The opportunity for forming physical and emotional bonds between mother and infant may be enhanced by breastfeeding and are considered to be very important to the infant.

• If the mother chooses to bottle feed, however, there are commercial formulas that contain known nutrients at levels to support growth and development. The infant should be observed to be sure he or she is thriving and is not intolerant to any ingredient. Care should be taken to prepare the formulas according to directions and under sanitary conditions. The mother's holding the infant during feeding can provide the important physical and emotional bonds to the mother.

• Since the first year of life is the fastest growth period of all, proper nourishment is critical to an infant's development. The gradual addition of solid foods between the ages of three to six months should be based on each child's health/nutrition needs and developmental readiness, and carefully evaluated by a knowledgeable medical or nutrition consultant. Prolonged breastfeeding without solid foods or supplemental iron can result in iron deficiency. It is recommended that salt or sugar not be added to baby's foods (4, 5).

Goal: To understand the function and interaction of nutrients and the variety of foods in which each is found in order to choose a balanced diet to support the pregnant woman and her fetus.

Key Concept 2: The pregnant woman and her fetus receive the nutrition their bodies need from nutrients—all are essential and each has a specific function in the body.

Focus 1: Appropriate amounts of protein, carbohydrates, fats, and water are necessary for the growth and energy of the pregnant woman and her baby.

SUGGESTED INFORMATION:

• *Protein:* Adequate protein provides for growth of new body cells and repair of injured ones, in both the mother and baby. For example, a lack of adequate proteins and calories during the last three months of pregnancy may limit the greatest growth period for the brain.

—Proteins come from animal sources such as meat, fish, poultry, egg and milk products, or vegetable sources such as dried beans, peas, and nuts.

—Because vegetable proteins must be eaten in combinations to be complete, *vegetarians* who become pregnant should consult a physician or nutritionist to ensure an adequate supply of protein and iron. For those who do not eat egg or milk products, calcium, vitamin B_{12}, and vitamin D may need to be supplemented.

• *Carbohydrates:* Carbohydrates provide energy thus sparing protein for cell growth in the mother's body and in the fetus.

—Carbohydrates include both sugars and starches that the body changes into energy. Sugars provide energy but little else. Starches, a main source for certain minerals and vitamins, also contain small amounts of proteins.

—Because carbohydrates assist in the protein functions, the pregnant woman should know that eliminating carbohydrates in an attempt to cut back on "fattening" foods may cause the body to use protein for energy resulting in a protein deficiency for cell and tissue building.

—Fiber is another necessary form of carbohydrate; during the last months it helps alleviate constipation. It can be found in fruits, vegetables, and whole grain breads and cereals.

—Carbohydrates are found in fruits and vegetables, flour, breads and cereals, dried beans, peas, rice, sweets, and sugars.

• *Fats:* Adequate amounts of fat are usually present in normal diets and may need to be limited rather than increased.

—Fats provide energy and make foods taste good. Vegetable oils provide essential fatty acids and some vitamin E. Fats and oils have more than twice the calories, ounce for ounce, than proteins, starches, or sugars, and provide a minimum of other nutrients. Also, since fats, cholesterol, and obesity are implicated in heart and blood pressure diseases, fats should be limited in favor of other energy sources containing essential nutrients.

—Meats, vegetables, and milk products include ade-

quate amounts of fat. Extra fats such as poultry skins, fat on meats, or butter and oils should be controlled.

• *Water:* Water, the most important nutrient, is important to the efficient operation of the body during pregnancy.

—Life can be sustained only a few days without water. About two and one-half quarts are lost every day as urine, perspiration, and respiration. During pregnancy water sustains increased blood volume and creation of new cells. Also, it is important for body waste elimination and—during lactation—the formation of mother's milk (1, 2, 8, 9, 11, 18, 19, 26).

Focus 2: Vitamins and minerals are essential to body functions and may need to be monitored by a medical advisor during pregnancy.

SUGGESTED INFORMATION:

• *Vitamins:* There are 13 vitamins, each plays a different role, and all are essential to health and the assimilation and function of other nutrients.

—During pregnancy or breastfeeding, folic acid, vitamin B_{12}, and vitamins A and D are especially important. The amounts needed should be determined for each individual by a medical advisor.

1. Vitamin A is found in yellow and dark green leafy vegetables.
2. Vitamin D works with calcium and phosphorus to develop and sustain bones and teeth. Vitamin D is added to pasteurized milk products but is not present in raw milk.
3. Meat, poultry, milk products, whole grains, and dried beans are good sources of B complex vitamins. Liver is a rich source of vitamin B_{12}.
4. Folic acid, which helps protect the body against anemia, is especially important during pregnancy. It is found in dark green leafy vegetables, liver, and many other foods. Since folic acid is lost easily in cooking, pregnant women are often given supplements by their medical advisor (2, 8, 13, 26).

• Because certain vitamins in excess may cause or contribute to fetal malformations, the supplemental use of all vitamins *should be carefully regulated by a doctor* (and reflect recommendations of agencies such as the Food and Nutrition Board) (24).

• *Minerals:* For good health the body needs small amounts of minerals; some are especially important in pregnancy.

—Bone minerals: *Calcium* is essential to the formation of bones and teeth. *Phosphorus* assists the assimilation of calcium. Milk and milk products, such as cheese, are major sources of calcium. For vegetarians who don't eat these foods, a medical advisor should prescribe supplements. During periods of bone and teeth growth, if calcium and phosphorus are not plentiful, the fetus will sap the mother's body for what it needs.

—Many blacks and non-northern European ethnic groups may have reactions to lactose, the principle sugar in milk. Recent studies indicate this is not as severe a problem as thought earlier (2, 13, 25). Most people can tolerate milk in small quantities (half to full cup) at any one time. For pregnant women who are truly intolerant of milk, alternatives include cheese, fermented dairy products, and lactose hydrolyzed milk (22).

—Fluid regulating minerals: pregnant women need a normal amount of sodium. *Potassium, sodium,* and *chlorine* (salt is a main source) help to keep the right amounts of fluids in the body. Inadequate sodium causes dehydration and excessive amounts cause edema. Since many foods contain sodium (even those that don't taste salty), it is unnecessary to add salt in cooking or flavoring to satisfy basic needs of 1,000-2,000 mg per day that pregnant women need.

A pregnant woman may want to eliminate foods where large amounts of salt have been added. This is not a simple task. Fast foods are often highly laced with sodium (as much as 950 mg per hamburger and 350 mg in milk shakes). Many canned and processed foods have more sodium than fresh foods. Even frozen peas may have as much as 100 mg. To maintain a sensible sodium level, the pregnant woman should read labels (1, 8, 16, 25).

—Minerals that make materials: Iron is vital to the formation of blood and carries the oxygen in blood. Because total muscle blood volume increases during pregnancy for both the mother and the fetus, the demand for iron also increases. Amounts of iron found in foods vary. The doctor will evaluate iron intake and prescribe iron supplements if necessary to prevent anemia. Good sources of iron and other minerals include lean meat, liver, dried peas and beans, dark green leafy vegetables, enriched bread and cereals, dried fruits such as prunes and raisins (1, 2, 7).

—Trace minerals: Zinc is important for utilization of proteins and the healing of wounds. Sources include whole grains, breads, meats, shellfish, and eggs.

Focus 3: Foods can be grouped by nutrient content to assist the pregnant woman in developing food plans and evaluating food and diet fads.

SUGGESTED INFORMATION:

• No one food contains all the nutrients but most foods contain combinations of nutrients. Choosing foods can be complicated without the assistance of a food plan or daily/weekly menu plan. It is important that learners understand:

—Size of servings

—The variety of food sources that allow for personal tastes, ethnic/cultural preferences, economic factors

—Number of daily servings to provide adequate amounts of each nutrient.

• Food fads and diets that either restrict or overemphasize one or more groups of nutrients are potentially dangerous to any person, but especially to the pregnant woman. Adolescents are often vulnerable to food fads of their age group. A balance of foods from each nutrient group, chosen from a wide variety of foods from within each group, is recommended as the safest way of ensuring proper nutrition.

• Vegetarians should get nutritional advice to ensure adequate supply of vitamins (especially vitamins D and B_{12}), calcium, complete proteins, and adequate calories.

• Because food choices and eating habits develop early in life, students need to have early experience evaluating their food choices. Of the numerous food grouping plans, one is discussed in a recent article, "The Hassle-Free Guide to a Better Diet," in USDA's publication *FOOD* (8). It identifies foods in five classes, four of which are the traditional ones. A fifth group includes fats, sweets, alcohol, and unenriched, refined bakery products. The program identifies basic serving sizes, and the number of daily servings for children under 9, 9-12, teens, adults, pregnant women, and nursing mothers. An explanation of the major nutrients and their function is simple but clear (8, 11, 13).

Goal: To recognize the process by which nutrients are added, lost, or changed in food handling and to assess nutrient content in commercially processed foods.

Key Concept 3: The way food is handled can change the nutrient content.

Focus 1: Methods of preparation and cooking change nutrient content.

SUGGESTED INFORMATION:

• Nutrient content changes in the processes of storing, preserving, preparing, and cooking foods. Vitamins and minerals are lost through peeling, soaking, or boiling vegetables, fruits, and other foods. Fresh, unpeeled, broiled, or steamed foods preserve nutrients best. The water from boiled, soaked, stewed, or roasted foods (after excess fat is removed) should be eaten to get nutrients drained from the foods. Extra fat, as found on meats or added during frying, can increase fat above recommended levels. Vegetables and fruits develop more carbohydrates/sugars as they age. Folic acid is easily lost in cooking.

• Proper storage, preservation, and protection of food against spoilage are critical to safeguard health.

Focus 2: Commercially processed, precooked, or "convenience" foods may have chemicals added to preserve them, enhance color, or improve nutrient levels. These may alter nutrient content and affect health in both positive and negative ways.

SUGGESTED INFORMATION:

• Progress in preserving and processing foods has

"When both parents know about nutrition's effect on the health of their baby, there is greater likelihood that theory will be put into practice."

increased the variety and safety of foods available regardless of season or geography. Foods have been fortified to provide nutrients not easily available in normal diets. For example, vitamin D in milk and iodine in salt have reduced diseases that were serious concerns a generation ago.

- The side effects of added chemicals are just beginning to be examined. A pregnant woman may want to consult a nutritionist or medical person who can identify any chemicals she should limit.
- Reading labels to identify nutrient content can help a pregnant woman make choices that fit her nutritional needs and economic situation (4).
- Nutrition is an expanding science with new discoveries still being made. Analyzing all the nutrients in natural foods is not developed to the point where every ingredient can be exactly determined or duplicated in food substitutes or supplements. Therefore, choosing a variety of brands of processed and natural foods from each food group offers the best chance for receiving all the nutrients the body needs (12, 21).

Focus 3: Skill in reading labels on food packages is essential to determine nutrient content in processed foods.

SUGGESTED INFORMATION:

- The simplest rule for label reading is "first is most." Even very young children can learn that the first ingredient listed comprises the largest quantity. Consumers are often surprised to find they are spending money on cereals purchased to provide grain content that contain a greater quantity of sugar than grain.
  - —Since sodium (salt) and sugar are ingredients that many people need to control, it is important to recognize their most common chemical names. All of the following are forms of sugar: glucose, dextrose, fructose, corn syrups. Words with soda or sodium in them as in mono*sodium* glutamate, or the initials Na are forms of sodium.
  - —If a food label provides nutrition information it must give the amount of protein, fat, and carbohydrates in a serving and the amounts of eight nutrients (protein, vitamin A, thiamine, riboflavin, niacin, vitamin C, calcium, and iron) in a serving expressed as a percentage of U.S. recommended daily allowance (U.S. RDA) (8, 2, 12, 19).
- As technology advances, parents will need to develop abilities in reading labels to protect their own and their family's health.

Goal: To identify the factors that influence food choices and eating patterns in order to develop a healthful nutrition program that fits the social/cultural and personal preferences of a pregnant woman.

Key Concept 4: Food choices are influenced by social, psychological, cultural, and economic factors.

Focus 1: Pregnant women are often influenced in their food choices by the father of their child, as well as other family and social contacts.

SUGGESTED INFORMATION:

- Parent education groups have found that the child's father can encourage the pregnant woman to follow a healthful eating program. When both parents know about nutrition's effect on the health of their baby, there is greater likelihood that theory will be put into practice. For instance, in some cultural groups, if food is limited, the woman is accustomed to supplying the man first. Both partners need to know how damaging this can be to the mother and baby.
- Since grandparents, parents, and peers also influence the eating patterns of the pregnant woman, education programs on nutrition for fetal health should include family and other significant people.
- Eating patterns and attitudes develop from an early age. If previous eating patterns have not been adequate, pregnancy offers a sustained time when regular medical counseling and high motivation can create improved eating patterns for the couple and their baby.

Focus 2: Food choices can be nutritious and still allow for ethnic, cultural, and personal food preferences.

SUGGESTED INFORMATION:

- Ethnic and cultural food choices should create no problem for a pregnant woman.
- Because of adolescent food practices—junk food and fast food—and peer pressure, a pregnant adolescent needs to keep careful record of daily intake of foods in order to include all the nutrients.

Focus 3: There are skills and resources to help a pregnant woman meet economic restrictions that affect nutrition.

SUGGESTED INFORMATION:

- In making choices among natural, precooked, processed, or "convenience" foods, a pregnant woman needs to consider nutrient content, cost, and personal energy available for food preparation. Generally, unprocessed foods are more economical than packaged or

pre-cooked foods. Instruction in preparing fresh or natural foods in quick and easy ways will help the pregnant woman use economical, nutritious foods.

- Protein sources are often the most expensive foods. A pregnant woman should know that less expensive cuts of meat are equally nutritious (the fat content is usually lower), eggs and powdered milk provide good quality protein, and vegetable proteins are inexpensive and valuable sources. A little animal protein can enrich vegetable dishes to make an inexpensive and complete protein source.
- Local, state, and federal government programs will assist a pregnant woman to attain adequate nutrition for herself during pregnancy and for her child after birth. The pregnant woman needs to be encouraged to be aggressive in getting help to provide quality nourishment during this period (4, 10).

Focus 4: Commercial food industries, through their advertisements and display techniques, exert great influence on food choices.

SUGGESTED INFORMATION:

- Advertising by food industries and distributors is intense, sophisticated, and highly manipulative. Although laws require advertising to be factual about product content and claims, companies are often free to choose those facts they will promote and those they will omit.
- Advertisements present products in ways that attach emotional and psychological values to their use. Pregnant women need skill in evaluating products for their positive or negative merits and comparing relative costs and nutrients (4).

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Environment Concept Chart.

The following chart keys into concepts expressed in the Environment chapter.

		Pre-school through Kinder-garten	Primary	Upper Elemen-tary	Middle/ Junior High	Senior High
KEY CONCEPT 1:	Drugs or chemicals ingested by a pregnant woman may have serious detrimental effects on the development and health of the fetus.					
Focus 1:	Many substances that the mother's system absorbs may cross the placenta and be introduced as is or in an altered form to the fetus.			Ⓐ	●	○
Focus 2:	A great variety of drugs and chemicals are proven or suspected of having serious consequences to the fetus.			Ⓐ	●	○
Focus 3:	Many chemicals that may be harmful to the fetus are in common use as prescriptive medicines as well as illegal social drugs.			Ⓐ	●	○
Focus 4:	Readily available drugs sold over the counter and other substances used for social purposes contain chemicals that may be dangerous to the health of the pregnant woman and the development of the fetus.	Ⓐ	Ⓐ	●	○	○
Focus 5:	Increasing use of drugs is a serious concern that requires insight into the many possible social and psychological causes to help prospective parents develop positive alternatives.			Ⓐ	●	○
KEY CONCEPT 2:	Other environmental factors besides nutrition and drugs that may endanger a pregnant woman and her fetus include radiation, disease, and industrial contaminants of the air, water, and soil.					
Focus 1:	The amount of radiation that causes birth defects or genetic damage is still in doubt, so precautions should be taken to protect the fetus, the pregnant woman, and the prospective father from unnecessary exposure.				Ⓐ	●

KEY TO SYMBOLS:

Ⓐ—Awareness. Concept can be introduced (with limited and appropriate examples) as it relates to science, social studies, or general observation of the human condition, and so on without going into the details of the content.

●—Concept can be expanded with enough detail to clarify cause and effect and the role this information plays in each person's life.

○—In-depth instruction of concepts taught at previous levels with expanded decision making, assessment of social impact, application to real problems.

Environment Concept Chart (continued)		Pre-school through Kinder-garten	Primary	Upper Elemen-tary	Middle/ Junior High	Senior High
Focus 2:	Many chemicals, especially those that pollute the air, soil, and water, are potentially dangerous to women and men of childbearing age, as well as a fetus, and are a growing concern to the health of all citizens.				Ⓐ	●
Focus 3:	Infectious disease can cause serious birth defects or infection in the fetus and newborn.	Ⓐ	Ⓐ	Ⓐ	●	○
Focus 4:	The process of delivery and birth can have physical and psychological effects on the newborn.				Ⓐ	●

KEY TO SYMBOLS:

Ⓐ—Awareness. Concept can be introduced (with limited and appropriate examples) as it relates to science, social studies, or general observation of the human condition, and so on, without going into the details of the content.

●—Concept can be expanded with enough detail to clarify cause and effect and the role this information plays in each person's life.

○—In-depth instruction of concepts taught at previous levels with expanded decision making, assessment of social impact, application to real problems.

Environment

Goal: To understand the effects that chemicals and drugs can have on the outcome of pregnancy.

Key Concept 1: Drugs or chemicals ingested by a pregnant woman may have serious detrimental effects on the development and health of the fetus.

Focus 1: Many substances that the mother's system absorbs may cross the placenta and be introduced as is or in an altered form to the fetus.

SUGGESTED INFORMATION:

- As the fetus receives nutrients through the mother's uterus wall and from the bloodstream, so may it receive harmful ingested substances. After the placenta forms and during the remainder of the first trimester, chemicals can produce permanent changes in the anatomical development of the fetus.
- The first 8-12 weeks are the most vulnerable time for the induction of birth defects. These early weeks are a special concern because the woman who may be using these chemicals may not know she is pregnant. After the first trimester, the fetus has completed the formation of basic organ and skeletal structures but remains vulnerable to growth retardation and failure of proper development of an organ or an organ system.
- The placenta does not screen out all harmful substances. Only a few drugs do not cross the placenta. Drugs that diffuse in the mother's brain and other organs will also have an effect on the fetal brain and organs. Chemicals will accumulate in the fetus at levels at least as high as in the mother. Size and frequency of dose is important in determining whether they will adversely affect the fetus. However, tolerance levels are difficult to determine because they vary with individual mothers and fetuses. The pregnant woman who understands this process may choose to safeguard her baby by eliminating substances that are known or suspected of causing damage to the fetus (7, 8, 28).

Focus 2: A great variety of drugs and chemicals are proven or suspected of having serious consequences to the fetus.

SUGGESTED INFORMATION:

- The testing of drugs and chemicals for potential harm to a fetus is not conclusive in most instances, but it does suggest that many medicines, as well as street drugs, can cause serious fetal damage. The type and severity of adverse effects on a fetus depend on many factors difficult to assess and isolate. The effect may depend on the size and frequency of dose, route of administration, state of pregnancy, maternal health and nutritional status, genetic makeup, the use with other medical or street drugs, smoking status, and even environmental pollutants. The information is difficult to gather because of the widespread adulteration and misbranding of street drugs and the difficulty of getting meaningful drug histories on pregnant women. Testing in humans is almost nonexistent because of potential danger to the mother and child.
- Although data is inconclusive some drugs are suspected of affecting fertility and chromosome makeup in males, as well as hormonal and fertility levels in females. This could affect not only the ability to have children but genetic makeup as well (8, 10).
- At this time testing of drugs in pregnant animals has been accepted by the FDA (Food and Drug Administration) as the best means of estimating birth defect potential. Approximately 600 drugs or chemicals have produced congenital defects in experimental animals. However, animals do not always react the same as humans. A frightening example is the approval of the drug thalidomide that produced severe human malformations but produced minor deviations in monkeys and rabbits and no results in mice and rats. About 1,000 new chemicals are introduced into the environment each year. It will take many years to identify effects of these drugs on humans or the human fetus. An expectant mother would be wise to refrain from using any medication or social drug not carefully prescribed by a doctor. A few months of careful behavior may avert a birth defect that the child and parents would live with for a lifetime (8, 28).
- The pregnant woman and expectant father should share responsibility with the doctor to question and evaluate the taking of drugs for medical reasons during pregnancy, delivery, and breastfeeding after birth.

Focus 3: Many chemicals that may be harmful to the fetus are in common use as prescriptive medicines as well as illegal social drugs.

SUGGESTED INFORMATION:

- Drugs, including those that affect the central nervous system, are in widespread use among those who may not recognize their effects on a pregnant woman and her fetus. In the United States there has been a high incidence of prescribed medicines, especially tranquilizers and diuretics, for minor or nonspecific medical reasons. Their use for any reason should be a concern to the pregnant woman.
- A pregnant woman who needs medication to control chronic disease, such as diabetes, epilepsy, or a woman on methadone for narcotics withdrawal needs special care. A physician may need to medicate conditions that occur because of pregnancy and during birth. Great care by an informed physician is required to balance these needs against danger to the fetus (1, 3, 8, 9).
- Abuse of prescription drugs is not uncommon. A pregnant woman must be careful to take correct dosages of prescribed medications, even vitamins. She also needs to know the danger of mixing them with other drugs, smoking, or alcohol. The combination can be life-threatening to mother and fetus (8).
- Use of illegal or street drugs shows a generally consistent upward trend in the United States, with an alarming increase in the use of marijuana among the very young teenager (ages 12-17) who now reports frequent rather than experimental use. Ages 18-25 represent the peak period of marijuana and drug use. The percentage of daily marijuana users has nearly doubled since the mid '70s. In addition, the strength of marijuana has increased markedly over these same years (7, 14).
- Use of drugs often inhibits the appetite and may result in lowered nutrition. Those who use drugs often combine them with alcohol, tobacco, other drugs, and over-the-counter medical remedies. Therefore the probability of fetal damage in the pregnant drug user is high (8, 14, 16, 18) (See Figure 1).

Figure 1. Some prescription or illegal street drugs that can affect the fetus (8, 10, 11, 16, 17, 18, 28).

Cause	Type	Effect
Birth control pills	Prescription	Should not be initiated until the female is sure she is not pregnant. Should never be taken after intercourse as pregnancy prevention.
Barbiturates, Tranquilizers (depressants), and Amphetamines (stimulants)	Prescription or illegal and street drugs	All can produce withdrawal symptoms in the newborn that may continue from one to six months after birth. Can trigger miscarriage and premature births. If the fetus is premature or has low birth weight, withdrawal symptoms can seriously jeopardize its life.
Narcotics	Include illicit drugs such as heroin and prescription drugs containing morphine or codeine	If mother is addicted, fetus will be addicted and experience all the symptoms of severe withdrawal that an adult experiences. May prove fatal if infant is weak or premature. Much higher incidence of toxemia, breach birth, prematurity, and premature separation of the placenta when narcotics are used by mother. Use of illicit narcotics increases chance that the mother may have hepatitis from unclean needles and infect the fetus.
Methadone	Agent prescribed to maintain the narcotic dependent person	The effect on the neonate is not clear cut. However, some studies indicate prolonged withdrawal symptoms may be tied to methadone use. Implicated in sudden infant death syndrome.
Marijuana	Street drug (occasionally prescribed)	Usually smoked so can cause the same kinds of damage to mother's lungs and lung capacity as found from smoking tobacco. Degree of damage may be higher because of chemical concentration in the smoke. One joint may decrease vital capacity in the lungs as much as 16 cigarettes a day. This limits flow of oxygenated and purified blood to the fetus. Evidence in animals shows chemicals in marijuana pass through the placenta, reach the fetus, and concentrate in the fetus' fatty tissues (including the brain). THC, a major component in marijuana, appears in the milk of nursing monkey mothers and in their offspring. Two studies showed that sperm count and motility were diminished and structural abnormalities in the sperm were noted following marijuana use. Fertility in females was affected and lowered levels of hormones that produce mother's milk were found.
Hallucinogenic drugs	Illegal street drugs (LSD, PCP, mescaline, DOM, STP)	Affect the central nervous system. Tests results remain inconclusive about fetal damage, but it is known that they affect the central nervous system of the fetus.

"The father of the child often has the greatest influence on the pregnant woman. . . ."

Focus 4: Readily available drugs sold over the counter and other substances used for social purposes contain chemicals that may be dangerous to the health of the pregnant woman and the development of the fetus.

SUGGESTED INFORMATION:

- The American people buy remedies for countless minor illnesses, as nutrient substitutes or supplements, and mood changers. Some of these affect the pregnant woman or the fetus. Of these, two are particularly prevalent and damaging:
  - —Alcohol and the resulting fetal alcohol syndrome that causes irreversible damage to the child.
  - —Smoking, where even an expectant mother's exposure to tobacco chemicals is implicated in birth complications or defects (See Figure 2).

Focus 5: Increasing use of drugs is a serious concern that requires insight into the many possible social and psychological causes to help prospective parents develop positive alternatives.

SUGGESTED INFORMATION:

- Early education in positive methods for handling stress, encouragement in developing a positive self-image and confidence, as well as the data on effects of drugs is essential to developing habits of a healthful lifestyle.
- A pregnant woman whose behavior patterns already include indiscriminant use of over-the-counter drugs or illegal street drugs needs help in analyzing her reasons for their use, the processes involved in changing behavior, and continuing counseling to help change behavior.
- The father of the child often has the greatest influence on the pregnant woman in limiting her use of alcohol and tobacco, as well as other drugs, but peers can be influential.
- Because use of these substances may be rooted in social and psychological causes, changes are not easy, may not be permanent in spite of good intentions, and require ongoing counseling and support. Control of this behavior is critical to the health and development of fetus and mother (4, 26).

Goal: To alert prospective parents to the current impact that radiation, contaminants, and disease may have on birth defects and the possible increase of these hazards in the future.

Key Concept 2: Other environmental factors besides nutrition and drugs that may endanger a pregnant woman and her fetus include radiation, disease, and industrial contaminants of air, water, and soil.

Focus 1: The amount of radiation that causes birth defects or genetic damage is still in doubt, so precautions should be taken to protect the fetus, the pregnant woman, and the prospective father from unnecessary exposure.

Figure 2. Some over-the-counter drugs that may affect the fetus (5, 6, 7, 9, 19, 23, 24, 25, 26, 31).

Cause	Type	Effect
Aspirin	Remedy for minor ailments Found in 80-85% of all over-the-counter medications	May interfere with blood clotting in fetus with potential for brain damage. Can cause hemorrhaging in mother and fetus during and after birth. May impede spontaneous breathing resulting in brain damage in fetus. While harmful effects are rare, even this relatively harmless drug should be avoided during pregnancy.
Sleep aids	Nonprescriptive	Often contain antihistamines, some of which have produced congenital deformities in animals.
Other common medicines	Nonprescriptive aids for minor illness and pain	Laxatives, antacids, nose drops, analgesics high in sodium, and others are not recommended during pregnancy. Large doses or combinations of several of these drugs under certain conditions can create unhealthy situations for the fetus.
Alcohol	Social drug, contains ethanol, congeners, and aldehydes	"Fetal alcohol syndrome" includes such symptoms as malformations of facial features, arms and legs, underdeveloped head size, and mental retardation. Related to alcohol use and the folate deficiency and malnutrition that often go with alcoholism. The minimum amount of alcohol intake that may cause these defects has not been determined. The critical alcohol level may be much less in some women than in others. Fetal alcohol damage is not reversible.
Tobacco	Social drug. Contains nicotine (a stimulant), carbon-monoxide, cyanide, formaldehyde, and many other chemicals	Each chemical directly affects the fetus and affects the efficiency of the mother's support system, especially the oxygen supply through the blood. Increases possibility of miscarriage, fetal distress (reduction in breathing movements resulting in oxygen deficiency), premature birth, low birth weight, and smaller body and head measurements. Low birth weight, with its risks of disability and failure to survive, is twice as common. Mothers who smoke or have smoked have a higher incidence of "sudden infant death" syndrome.
Caffeine	Stimulant. Found in coffee, tea, cola and other soft drinks, cocoa, and chocolate, headache, cold, allergy, and stay-awake pills, pain killers, and some prescription drugs	Suspected of creating changes in fetal heartbeats and other functions. Animal studies indicate can cause deformities in skeletal and bone development. Although this data is not confirmed for humans, pregnant women are encouraged to limit the amounts of caffeine they use.

SUGGESTED INFORMATION:

• Ionizing radiation can damage genes in sperm or egg cells so that genetic abnormalities may appear in later generations. It can also damage or kill cells of the developing embryo, leading to growth retardation, malformations (although doses high enough to cause malformations usually cause miscarriage), or death in the prenatal or newborn period.

• Radiation comes from natural sources (cosmic rays, the earth, atmosphere, food, water, and our own bodies) and from man-made sources (color TV, eyeglass lenses, x-rays, gamma rays, and nuclear power plants). Only a few produce enough radiation to cause concern for health.

• To be safe, it is recommended that pregnant women have no unnecessary x-rays or radiation exposure. There seems to be no "threshold" level below which radiation does no damage, although there are levels below which effects cannot be proved or measured. This applies to causation of cancer and even more to genetic damage. Therefore, every woman should:

—Weigh, with medical experts, the risk vs. benefits of x-ray examinations and treatments.

—Postpone dental x-rays until after birth of child.

—Be sure the radiologist takes precautions to ensure she is not pregnant before doing pelvic or lower abdominal x-rays. The embryo's most sensitive stages of development are before a woman knows she is pregnant.

—Protect the abdomen completely with a lead shield apron before taking any x-rays that are absolutely necessary during pregnancy.

—Check with the doctor or dentist to be sure that the new lower dose x-ray equipment is used for any x-rays deemed essential during pregnancy, or see if ultra sonography can be used instead.

—Not use radioactive iodine for overactive thyroid

after the sixth week of pregnancy as it can destroy the fetal thyroid. If the mother has used this treatment, the infant should be tested at birth to determine if infant's thyroid has been affected. Supplemental thyroxin can prevent irreversible central nervous system damage (possible by third month), mental retardation, and physical abnormalities.

- Be sure there are no radiation dangers at place of work (3, 21).

Focus 2: Many chemicals, especially those that pollute the air, soil, and water, are potentially dangerous to women and men of childbearing age, as well as a fetus, and are of a growing concern to the health of all citizens.

SUGGESTED INFORMATION:

• It is difficult to test for specific results of contamination from the more than 50,000 chemicals on the market. But 35,000 have been classified by Environmental Protection Agency as being either definitely or potentially hazardous to human health.

• Occupational Safety and Health Administration estimates that one million women of childbearing age could be working in hazardous environments. Often chemicals are regulated but not always with the protection of the childbearing woman in mind.

Some potentially dangerous chemicals in many businesses may not be thought of as dangerous to pregnant workers. These may include beauty parlors, dry cleaners, photocopy shops, gardens, nurseries, farms, and so on.

• The concerned person will need to continuously check the current status of these chemicals and their dangers by contacting OSHA in Washington, D.C.

• Besides occupational hazards, chemicals known to cause birth defects or under suspicion because of their known hazards to human beings after birth include:

—Before Birth: PCB–birth defects and nervous disorders; Lead–nervous disorders, mental retardation, and death.

—After Birth: Kepone–sterility; Benzene–leukemia; Asbestos–lung cancer; Vinyl-chloride–cancer of the liver.

• Lead is a particular concern because persons working around lead can carry it home on their clothing and contaminate the pregnant woman or young child. Old houses with lead paint can contaminate and damage both adults and children if ingested (15, 28) (See Figure 3).

Figure 3. Examples of some chemicals that OSHA lists as producing or are suspected of producing birth defects (28).

Chemical	Type of Job With Possible Risk
Benzene	Paint and cleaning agent industry
Toluene	Paint industry
Organic solvents	Motor industry
Organic dyes	Fabric industry
Vinyl chloride	Plastics industry
Mercury	Insecticide industry Fungicide industry
Halothane	Operating room personnel
Carbon monoxide	Traffic police personnel
Lead	Parking lot attendants Toll booth workers
Thallium	Mining
Cadmium	Motor industry
Arsenic	Smelting industry Chemical warfare industry

Focus 3: Infectious disease can cause serious birth defects or infection in the fetus and newborn.

SUGGESTED INFORMATION:

• *Rubella* (German measles) contacted by the pregnant woman during the first three months can result in miscarriage, stillbirth, or serious birth defects, including loss of hearing, impaired vision, congenitally damaged heart, and mental retardation. For those infected during the first eight weeks, more than 50 percent of the babies are likely to have multiple abnormalities. Recent information indicates that the fetus may also be affected when rubella occurs during the second trimester.

• Congenital rubella occurs when the fetus itself is infected with the disease in the uterus. The child may be infectious at birth and continue to suffer further damage from the virus after birth. Some defects do not show up until sometime after birth.

• This is a completely *unnecessary* tragedy because it is possible to immunize against rubella. Yet about one in seven women of childbearing age in this country are still susceptible to the disease. Immunization should be encouraged for those who may infect pregnant women as well as girls who may one day become pregnant. They include:

—All girls before the onset of puberty

—All children after the age of 12 months

—Post puberty women, *only* if tests prove she is not pregnant at the time of innoculation with the understanding that she should not get pregnant for *at least three months* after immunization

—The general population, especially young adults and those working in hospitals or clinics, to eliminate the spread of the disease to vulnerable pregnant women (12, 20).

—**NOTE:** Those who have had innoculation for "regular measles" should be immunized against rubella because it is not the same disease.

• Sexually transmitted diseases.

—*Syphilis* is passed from the mother's blood stream to the fetus any time after the 14th to 18th week of pregnancy or during birth from active sores in the mother's birth canal. It creates serious and widespread malformation, sores, and disease of

many organs and bones in the newborn. It can emerge after a latent period in the growing child, causing blindness, deafness, heart defects, sores, mental retardation, and a wide array of other symptoms. Treatment of the pregnant woman with antibiotics before the 14th-18th week can eliminate these dangers. But re-infection can occur through sexual contact with an infected partner, and the symptoms may not be obvious in time to protect the fetus.

—*Gonorrhea* can cause severe damage in the female's fallopian tubes resulting in permanent sterility and a susceptibility to ectopic (tubal) pregnancy which can lead to death for a woman. Newborns may contract a severe eye infection during birth that must be treated immediately. Since symptoms are often hard to detect in a woman and may go undetected for a long time and because gonorrhea is so damaging to females, males are encouraged to inform their sexual partners if they become infected. Gonorrhea can be cured by antibiotics.

—*Herpes Progenitalis (Herpes 2)* is an incurable virus at this time. It can infect the infant during birth. Caesarian section is often used to keep the fetus from contamination from the vaginal wall. Herpes 2 is linked to cervical cancer in women.

—*Cytomegalovirus (CMV)* infection, a virus, can infect the newborn infant and is a leading cause of congenital mental retardation. There is no known treatment (27, 28, 29, 30).

Focus 4: The process of delivery and birth can have physical and psychological effects on the newborn.

SUGGESTED INFORMATION:

• There is a growing awareness that the drugs and procedures used during delivery must be carefully controlled to minimize injury to the fetus. In choosing a method and place for delivery, parents must consider the safety of both the mother and the baby. Expectant parents need to discuss with their medical advisor the drugs (if any) to be used during delivery and their potential danger to the baby.

• Choice of hospital or home delivery is a controversial one. Because emergencies that can seriously affect the baby's well-being can occur within minutes, emergency medical care should be readily available during birth.

—Some cities are developing programs such as specially equipped emergency vehicles that provide immediate support for those women having babies at home.

—In other places, hospitals are providing a home-like atmosphere in labor rooms and often allow delivery in the same room. They may even allow siblings to visit during and after birth.

—Hospitals provide emergency medical services but may expose mother and baby to infections. Home delivery is psychologically supportive but may lack sanitary or emergency conditions. Parents

"In choosing a method and place for delivery, parents must consider the safety of both mother and baby."

need to weigh the benefits and dangers in making decisions about location of birth.

- In the last few years there has been growing concern for psychological and emotional traumas that occur to the baby during its birth. Efforts are being made to create a quiet atmosphere, gentle handling, and instant bonding opportunities with the mother and father. Ten-year studies of youngsters handled this way at birth will soon be available and will measure attitude toward new experiences, relationships to parents, and general psychological and emotional well being. Since birth defects may be in the area of the psyche as well as the physical body, this dimension may be interesting for prospective parents to investigate (2).

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Genetics Concept Chart.

The following chart keys into concepts expressed in the Genetics chapter.

		Pre-school through Kinder-garten	Primary	Upper Elementary	Middle/ Junior High	Senior High
KEY CONCEPT 1:	Heredity is the expression of genetic information inherited from prior generations in a new living organism.					
Focus 1:	Each species has identifiable characteristics passed on to new generations through the processes and patterns of heredity.	Ⓐ	Ⓐ	○	○	○
Focus 2:	Although all human beings share common traits and characteristics, they are expressed differently among population groups and in unique ways for each individual.	Ⓐ	Ⓐ	●	○	○
Focus 3:	Each person exhibits individual characteristics and traits that may be valued differently by the individual, families, and society.		Ⓐ	●	○	○
Focus 4:	There is a continuous variation within each species.			Ⓐ	◗	○
KEY CONCEPT 2:	Environment and heredity interact to affect the expression of inherited traits.					
Focus 1:	It is often difficult to distinguish genetic from environmental effects in physical and mental characteristics.			Ⓐ	●	○
Focus 2:	Nutrition and other environmental factors can enhance, limit, or change development of some inherited characteristics.	Ⓐ	Ⓐ	●	○	○
KEY CONCEPT 3:	Cells, the basic structure of living things, contain genetic information from past generations that will be passed to the next generation.					
Focus 1:	A complex yet remarkably efficient system passes hereditary information from father and mother to offspring.			Ⓐ	●	○

KEY TO SYMBOLS:

Ⓐ—Awareness. Concept can be introduced (with limited and appropriate examples) as it relates to science, social studies, or general observation of the human condition, and so on without going into the details of the content.

●—Concept can be expanded with enough detail to clarify cause and effect and the role this information plays in each person's life.

○—In-depth instruction of concepts taught at previous levels with expanded decision making, assessment of social impact, application to real problems.

Genetics Concept Chart (continued)		Pre-school through Kinder-garten	Upper Primary	Middle/ Elemen-tary	Junior High	Senior High
Focus 2:	Genetic information is passed from each parent to offspring through the fertilization and division of cells.			Ⓐ	●	○
Focus 3:	Most cells contain chromosomes made up of genes encoded in the DNA (deoxyribonucleic acid) molecule. They carry genetic information and interact to determine the way genetic potential will be expressed.					
	A. There are predictable patterns to transmission of genetic information.			Ⓐ	●	○
	B. Some genes act as the control for activating other genes and influencing differentiation and cell functions.				Ⓐ	●
KEY CONCEPT 4:	Growing knowledge about heredity and increased recognition of genetic disorders and birth defects are important aspects in making decisions for responsible childbearing.					
Focus 1:	Genetic disorders and birth defects are common problems that are assuming an increasingly large percentage of total health concerns.			Ⓐ	●	○
Focus 2:	Among the several thousand known genetic disorders, certain conditions occur more frequently than others, with some ethnic or racial groups having a high risk for specific disorders.				Ⓐ	●
Focus 3:	While the impact of genetic disorders on a newborn is great, clinical manifestation of hereditary defects can occur at any age from birth through maturity.			Ⓐ	●	○
KEY CONCEPT 5:	Genetic disorders and birth defects may be transmitted in several different ways.					
Focus 1:	Some genetic conditions are a result of chromosome abnormalities.				Ⓐ	●
Focus 2:	Some genetic conditions and birth defects are a result of single-gene defects: dominant inheritance, recessive inheritance, or *x*-linked inheritance.				Ⓐ	●

Genetics Concept Chart (continued)		Pre-school through Kinder-garten	Primary	Upper Elemen-tary	Middle/ Junior High	Senior High
Focus 3:	Genetic diseases may be a result of multi-gene inheritance or interaction of multi-genes and environmental factors.				Ⓐ	●
KEY CONCEPT 6:	Some genetic disorders and diseases can be prevented, predicted, diagnosed, or treated.					
Focus 1:	Some genetic diseases can be prevented or treated.			Ⓐ	●	○
Focus 2:	There are several ways to predict or diagnose genetic disorders and diseases.			Ⓐ	●	○
Focus 3:	Medical and genetic counseling can assist prospective parents to identify their genetic status and the variety of options available to them.				Ⓐ	●
KEY CONCEPT 7:	Individuals and society face psychological, economic, and ethical consequences caused by genetic conditions and the medical advances being made to identify and treat them.					
Focus 1:	Everyone should be helped to appreciate unique qualities in self and others and to fully develop individual potential in spite of or because of inherited characteristics.		Ⓐ	●	○	○
Focus 2:	Some genetic disorders can cause physical, emotional, and economic stress that can result in both positive and negative consequences for individuals and families.			Ⓐ	●	○
Focus 3:	Some genetic conditions can be costly to society.				Ⓐ	●
Focus 4:	Advances in genetic medicine have raised important ethical questions.				Ⓐ	●

KEY TO SYMBOLS:

Ⓐ—Awareness. Concept can be introduced (with limited and appropriate examples) as it relates to science, social studies, or general observation of the human condition, and so on without going into the details of the content.

●—Concept can be expanded with enough detail to clarify cause and effect and the role this information plays in each person's life.

○—In-depth instruction of concepts taught at previous levels with expanded decision making, assessment of social impact, application to real problems.

Genetics

Goal: To develop an awareness of the ways by which human beings exhibit continuity as a species, individuality in each person, and *variation* or *diversity* among human groups and families.

Key Concept 1: Heredity is the expression of genetic information inherited from prior generations in a new living organism.

Focus 1: Each species has identifiable characteristics passed on to new generations through the processes and patterns of heredity.

SUGGESTED INFORMATION:

- Like begets like. Humans have human babies, dogs have puppies, horses have colts, and frogs produce tadpoles.
- Human beings are alike in many basic physical, intellectual, and emotional ways.
- Each new generation will exhibit distinguishing characteristics of its species because of genetic information passed from parents to offspring.
- In the life cycle some traits that identify this continuity may be obvious in a newborn, while other features may not emerge until later stages of childhood, adolescence, or adulthood.
- Each species demonstrates predictable patterns in its developmental stages. Human beings grow through anticipated stages that follow a pattern. (See Human Growth and Development.)
- Sharing common human characteristics can be reassuring and provide a sense of security and belonging (8, 28).

Focus 2: Although all human beings share common traits and characteristics, they are expressed differently among population groups and in unique ways for each individual.

SUGGESTED INFORMATION:

- All human beings are distinguished from other animal species by obvious common physical characteristics such as arms, legs, hair, and body shape, plus intellectual and emotional capabilities.
- However, there is so much variation in expression of human characteristics that no two people are exactly alike. (A possible exception may be identical twins who have the same genetic constitution.)
- Since each parent contributes one half set of a paired set of genes to new life, the number of combinations of genetic information are almost infinite. As patterns of heredity operate and mutations occur (spontaneously or induced through environmental factors), new genetic information is formed. This creates continuous individual expressions of basic human characteristics.
- Certain racial or ethnic groups exhibit common human traits in ways that contrast with other groups, yet individuals within that group will express these traits in unique ways. For example, Native Americans will most often have dark hair and eyes, while Scandinavians will most often have blue eyes and blond hair.
- Within families, brothers and sisters may share strong family resemblance, yet each individual will have features uniquely his or her own.
- This variety adds interest and is an important contribution to the vitality and dynamic qualities of life (8, 23).

Focus 3: Each person exhibits individual characteristics and traits that may be valued differently by the individual, families, and society.

SUGGESTED INFORMATION:

- Some traits will be valued as more positive and desirable to quality of life than others.
- Everyone essentially has traits that cause some negative impact on mental or physical abilities. Degree of impact varies from minimal to severe but most often falls somewhere between the two extremes.
- Each trait can be considered to fall somewhere on the continuum between normal/abnormal, health/disease, advantage/disadvantage according to the way it affects an individual life. Everyone faces the challenge of compensating for or blending personal traits into a satisfying whole (7, 8, 16).

Focus 4: There is a continuous variation within each species.

SUGGESTED INFORMATION:

• Because living organisms are dynamic and influenced by hereditary and environmental factors, each species is in a state of continuous change.

• Variations among populations of the same species are often a result of interaction of the genes of a given population with their environment. Discovering causes for differences among populations can help young people appreciate that these variations often are signs of a strength that permitted group adaptation and survival in a less than friendly environment. For example, people who survived in high density sunlight areas are considered to be those whose darker skin pigment helped screen out negative effects of the sun. Some geneticists speculate that the critical element controlled by pigment may have been the amount of Vitamin D that would be synthesized. Those whose skin moderated Vitamin D synthesis survived, and their tendency to dark skins was passed to future generations.

• Most people today no longer adapt to environment primarily by means of body surfaces, but rather by means of language and culture. However, increase in environmental factors of radiation, drugs, and chemicals in the air, water, and soil, may be causing changes that will again allow people with certain traits to survive while others will decrease and/or die out.

• Knowledge about complex influences on heredity is tentative and excitingly open to new knowledge to help explain the wonders of both discontinuity and variation (8, 23).

". . . there is so much variation in expression of human characteristics that no two people are exactly alike."

Goal: To recognize that while some human capabilities and limitations are defined by genotype, the individual and society have some control over others through environmental factors.

Key Concept 2: Environment and heredity interact to affect expression of inherited traits.

Focus 1: It is often difficult to distinguish genetic from environmental effects in physical and mental characteristics.

SUGGESTED INFORMATION:

• Although some birth defects can be attributed to a predominantly single environmental or hereditary cause, the majority are thought to result from a complex interplay between the two. Genes are continuously subject to environmental factors within or outside cells of which they are a part. They do not act except in an environment. Each environmental factor may influence the way and degree to which genetic information is expressed or developed. Therefore, it is often difficult to determine if a trait, disease, or degree of development of physical or mental capabilities resulted from an original genetic factor, from environmental exposure, or as a result of interaction between the two. (See Environment Chapter.)

"A complex yet remarkably efficient system passes hereditary information from father and mother to offspring."

• Many genes that produce neutral effects in one environment may cause harmful effects in another. Certain persons are apparently more susceptible to certain genes than others. Also, some persons are more susceptible to certain environmental effects than others.

• How strongly a fetus or child may be affected by given environmental causes may depend on a genetically determined susceptibility. For instance, many normal babies were born to mothers who took thalidomide or caught rubella during pregnancy. Possibly these children inherited greater resistance to these environmental influences than other children. Conversely, an unfavorable genetic makeup may render a child more susceptible to potentially damaging influences (4, 8, 23).

Focus 2: Nutrition and other environmental factors can enhance, limit, or change development of some inherited characteristics.

SUGGESTED INFORMATION:

• Nutrition is a critical factor in determining the degree to which inherited potential will develop, both before birth and after. Whatever the inherited traits, no organism can grow into a healthy adult without adequate supply of necessary nutrients to support growth and development. (See Nutrition.)

• For persons with genetic susceptibility to chronic diseases such as coronary heart disease, hypertension, diabetes, and certain cancers, diet and lifestyle may increase or minimize the probability that these genetic-linked diseases will emerge in later life (4).

• Chemicals, drugs, radiation, disease, and other environmental factors can interfere to cause changes in development of genetic potential for physical and mental development. (See Environment Chapter.)

Goal: To understand the ways by which hereditary factors are normally transmitted from parent to offspring.

Key Concept 3: Cells, basic units of living things, contain genetic information from past generations. Sex cells (sperm and egg) pass this information to the next generation.

Focus 1: A complex yet remarkably efficient system passes hereditary information from father and mother to offspring.

SUGGESTED INFORMATION:

• Both mother and father contribute equally to children's inherited characteristics though each contribution may not *appear* equal.

• In spite of a new human being's complex development from a single fertilized cell, *most* human newborns are well-formed and healthy.

• In order to understand possible combinations of inherited traits, young people need to understand the basic process by which cells divide and transfer their genetic information.

Focus 2: Genetic information is passed from each parent to offspring through the sex cells and the process of fertilization and division of cells.

SUGGESTED INFORMATION:

• All humans (as well as all independent, active, living things) are made of cells. Every human originates as a single fertilized cell that divides over and over to make billions of cells in a mature human being. The process of cellular reproduction holds the key to heredity in all living things.

• Cells contain chromosomes made up of thousands of genes encoded in the DNA (deoxyribonucleic acid) molecule. These genes contain information necessary for human physical development and are sometimes thought of as a blueprint for a human's structure and form.

—Human cells contain 23 pairs of chromosomes (for a total of 46), half of each pair is contributed by the sperm cell from the father and the other half by the egg cell from the mother.

—There are two kinds of cells: (1) Sex cells (ultimately the sperm and egg or ovum) and (2) somatic cells (all the cells except sex cells). Sex cells contain a single set of 23 chromosomes, one of which is a sex determining chromosome. The other 22 chromosomes are called autosomes.

• The two kinds of cells reproduce themselves in different ways.

—Somatic cells divide by first creating a duplicate set of chromosomal material and then dividing once to create two cells. Each new cell has a complete set of 23 pairs of chromosomes (one pair being sex chromosomes), each with the same information as the original cell. The process leading to somatic cell division is called *mitosis*.

—Sex cells (sperm and egg) are formed by specialized cells developing a set of duplicate chromosomal material and then dividing two times to potentially produce four new sex cells. Each new cell has one single set of chromosomes (22 autosomes and 1 sex chromosome). The egg will always have an *x* sex chromosome. In the sperm, half will contain an *x* and half will contain a *y* sex chromosome. The ways these combine determines the sex of the new human organism. When a *y* sperm fertilizes an egg, an *xy* male is formed. Conversely, when an *x* sperm fertilizes an egg, an *xx* female is formed. The process leading to sex cell production is called *meiosis*.

• During reproduction, when two sex cells join, a single set of chromosomes from the male sperm pairs up with the set from the female egg and creates a fertilized cell containing hereditary information from each parent. Each new cell formed thereafter will contain this combined information.

• Since the numbers of genes from each parent are in the tens of thousands, the combinations possible when two sex cells merge are almost infinite and produce each individual as unique (8, 11, 12, 23).

Focus 3: Most cells contain chromosomes made up of genes encoded in the DNA (deoxyribonucleic acid) molecule. These contain genetic information and interact to determine the way genetic potential will be expressed.

SUGGESTED INFORMATION:

• There are predictable patterns to transmission of genetic information.

—Chromosomes carry many thousands of genes. Since chromosomes occur in pairs, genes are also paired. Each pair of genes contains specific information for specific traits. One gene of each pair comes from the female parent and the other one comes from the male parent.

—Difference in the encoded DNA of one or the other or both genes of a pair makes a difference in the characteristics of the organism.

—Some genes are dominant and some are recessive.

—When a dominant gene and a recessive gene are paired, the dominant gene characteristic is usually expressed.

—The recessive characteristic will not be fully expressed unless it is paired with another recessive gene.

—Although a recessive gene is not expressed, it is not lost, nor does it blend with other genes. It is passed on intact to future generations and may express itself through future gene pairings. Therefore, a trait may emerge after skipping several generations.

—Many characteristics such as widow's peak, tongue rolling, and attached ear lobes follow this pattern. Also, certain genetic disorders and diseases can be predicted by dominant and recessive traits. Even though hair and eye color are a result of more complex gene actions, they are often used as teaching examples of this pattern because these traits are more easily traced in family histories (7, 8, 17, 23). (See Key Concept 5.)

• Some genes act as the control for activating other genes and influencing differentiation and cell functions.

—Most cells with a nucleus have a complete copy of genetic information and have (or had) the potential to become any part of the body structure (blood, skin, kidney) or perform any cell function (produce eye pigment, sweat, stomach acid).

—Whether a cell is activated ("turned on") to become or perform a specific role or function is determined by a complex mechanism relating to genes themselves and the previous relationship between the cell, its genes, and environment. Therefore, a cell in the toe has the genetic information to become eye pigment but does not because of this complex system of cell activation.

—DNA is fragile and susceptible to environmental influences which may affect the messages of the genes. If DNA control is normal, the organism will be instructed to develop in a normal way. However, errors in the process may strike at random, either spontaneously or induced by en-

vironmental factors. When this happens, cells may not be instructed to play their proper role and disorders may occur, ranging from trivial to devastating consequences. It is thought that loss of normal cell control can lead to cancer (11, 12, 17, 23).

Goal: To realize that heritable characteristics contribute significantly to the health status of individuals, families, and society.

Key Concept 4: Growing knowledge about heredity and increased recognition of genetic disorders and birth defects are important aspects in making decisions for responsible childbearing.

Focus 1: Genetic disorders and birth defects are common problems that are assuming an increasingly large percentage of total health concerns.

SUGGESTED INFORMATION:

• Until World War II, the greatest health concerns were diseases such as tuberculosis, typhoid, malaria, and others caused by infection, pests, or nutritional deficiencies. The effective use of antibiotics to treat infectious diseases, immunization, sanitation and pest control, and treatment for the causes of nutrition deficiency diseases, have eliminated or decreased the percentage of such environmentally caused health concerns in the United States and much of the world. However, genetically-based disorders constitute a greater percentage of hospital, medical, and institutional care. Contributing factors include:

—Modern technology makes it possible to save more newborns and others with genetic or multifactorial disorders who would not have survived in previous years.

—Predisposition to certain chronic diseases such as coronary heart disease, diabetes, hypertension, certain forms of arthritis, some forms of mental illness, and some cancers, arteriosclerosis, myopia, and even hayfever are now being identified as sometimes genetic in origin.

• The range of genetic diseases goes from rare to frequent, from merely inconvenient to painful, from benign to fatal. All ages, both sexes, and all races are affected. All the body's tissues and organs are at risk (5, 6, 8, 27).

• Research in genetic influences on birth defects is relatively young, so current statistics represent only a small portion of the problem. Current estimates suggest that:

—12 million Americans carry genetic diseases due wholly or partially to defective genes or chromosomes.

—36-40 percent of all spontaneous abortions are caused by gross chromosomal defects (amounting to more than 100,000 per year in the U.S.)

—At least 40 percent of all infant mortality results from genetic factors.

—Genetic defects are present in 4.8 - 5 percent of all live births.

—Of the 3 percent of the U.S. population who are mentally retarded, about four-fifths are believed to carry a genetic component.

—About one-third of all patients admitted to hospital pediatric wards are there for genetic related reasons.

—10-12 percent of our population is estimated to have enzyme abnormalities or other genetically determined deficiencies which make them likely to react adversely to one or another of many commonly used drugs (27).

• As more attention is focused on the effects of heredity on disease, more emotional, economic, ethical, and social pressures will fall on prospective parents as they consider genetic factors along with environmental and social factors in their decisions about childbearing.

• Much of the specific information about genetics has been discovered since the early 1950s. Since then the ability to examine and even change the form and function of elements of genetic information has opened new fields for study about causes, diagnosis, and prevention of genetic diseases and conditions. During the next few decades, today's students will need to remain alert to new discoveries that will help them assess genetic impact on their own health and that of their offspring (4, 8, 27).

Focus 2: Among the several thousand known genetic disorders, certain conditions occur more frequently than others, with some ethnic or racial groups having a higher risk for specific disorders.

SUGGESTED INFORMATION:

• This project's primary purpose for teaching about the growing impact of genetic conditions on individuals and society is to develop a general awareness that these problems may affect decisions about childbearing. General emphasis should be on introducing a few examples to illustrate how genetic disorders affect an individual's and a family's lifestyle, rather than presenting a long list of disorders that don't occur frequently enough to merit study and can be frightening.

• Great care and tact must be shown to protect sensitive feelings of those students who may have affected family members or friends. Be careful to choose examples that are realistic yet won't stigmatize an individual, family, or racial group (See Figure 1).

• The Center for Education in Human and Medical Genetics suggests a case study format for studying genetic conditions. This allows focus to be on a person first and a disorder second. It is also an opportunity to reflect that every person has some less desirable characteristics as well as highly desirable ones. Each characteristic falls in a different place on the continuum between health/disease and advantage/handicap.

—Semantics make a difference in approach. "Diabetic," "hemophiliac," and "handicapped child" become "a child with diabetes," "a boy with hemophilia," "a girl with a handicap." Also, the labels genetic condition or disorder rather than disease promotes a more appropriate understanding (7, 27).

Figure 1. Some examples of common genetic conditions (1, 2, 5, 10, 21, 22, 24, 25).*

Birth Defect:	Involvement:
Structural	
Clubfoot	Misshapen foot
Cleft Lip/Palate	Lip and palate incomplete, malformed
Polydactyl	Extra fingers, toes
Structural/Functional	
Down syndrome	Physical malformation, mental retardation
Spina Bifida/anencephalus	Incomplete spine
Hydrocephalus alone	Water on the brain
Functional	
Muscular dystrophy	Impaired voluntary muscular function
Cystic fibrosis	Respiratory and digestive system malfunction
Metabolic	
Diabetes	Inability to metabolize carbohydrates
Phenylketonuria (PKU)	Inability to metabolize specific amino acid
Tay Sachs disease	Inability to metabolize fats in nervous system
Lactose deficiency	Inability to hydrolize lactose (sugar in milk)
Blood	
Hemophilia	Poor clotting ability
Erythroblastosis (RH incompatibility)	Destruction of red blood cells
Sickle cell anemia	Altered capability of exchanging oxygen and carbon dioxide
Thalassemia	Blood disease, anemia

*This list does not reflect the genetic related chronic disorders such as heart disease, stroke, hypertension, arteriosclerosis, and others.

Figure 2. Certain genetic disorders in relation to a particular heritage (8, 22, 23, 24, 25).

Condition	Ethnic Groups Primarily Affected
Cystic fibrosis	Caucasians (middle European origin)
Phenylketonuria (PKU)	Caucasians and Orientals
Sickle cell anemia	Blacks and Mediterraneans
Tay-Sachs disease	Ashkenazi Jews (origins in central and eastern Europe)
Thalassemia	Mediterraneans

• Certain genetic disorders commonly found in the general population occur most frequently in people who have a particular heritage (See Figure 2).

—Sometimes geographical origins may be an important factor. For example, recent studies suggest

that sickle cell anemia may be prevalent in populations that originated in malaria-infested geographic areas. Red blood cells with sickle cell traits, a mixture of normal sickle cell hemoglobin, are more resistant to malaria. Those with "normal" blood and those who were "anemic" often died of either malaria or sickle cell anemia. Only carriers, those with sickle cell trait, survived, increasing the incidence of sickle cell anemia in their offspring (23).

Focus 3: While impact of genetic disorders on a newborn is great, clinical manifestation of hereditary defects can occur at any age from birth through maturity and into old age.

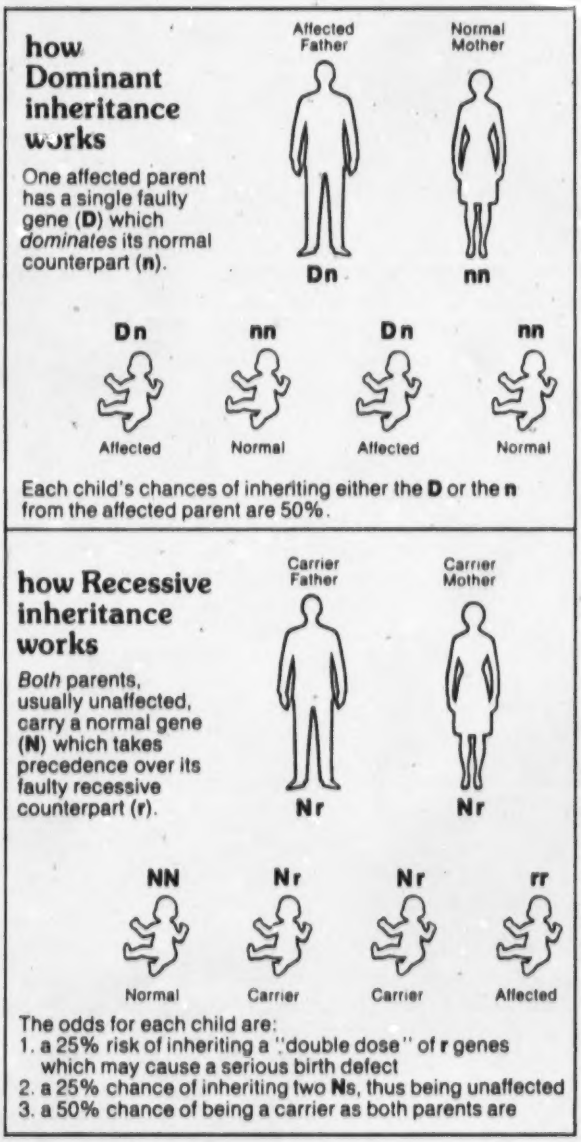
SUGGESTED INFORMATION:

- Obvious defects, especially structural ones, may easily be noted at birth. For example, club foot, spina bifida, cleft lip or palate.
- Some disorders that can be treated to prevent disabilities may be present, but the symptoms may not be obvious. For instance, PKU (phenylketonuria), the inability to metabolize a specific amino acid, can create severe, irreversible mental retardation. There are no indications of this metabolic condition at birth unless blood tests are made. Because corrective diet can prevent serious defects from occurring, a majority of states have mandated blood tests for PKU for every newborn infant. In recent years regular screening and treatment for a number of metabolic disorders have caused marked decrease in numbers of children with the severe disabilities usually caused by these conditions (14, 18, 26).
- Symptoms of some other defects may not appear until weeks, months, or even a year or so after birth. Some examples are: Tay-Sachs disease, cystic fibrosis, sickle cell anemia, hearing loss, diminished sight, and some kinds of mental retardation or minimal brain disfunction (and PKU if not discovered and treated immediately after birth).
- Symptoms of other defects appear in older children or adults. For example: Muscular dystrophy, diabetes, lactose deficiency, and Huntington chorea. Susceptibility to chronic diseases such as coronary heart disease, hypertension, arteriosclerosis, and gout is now considered to be related, at least in part, to genetic factors (4, 8). It is thought that some chronic disorders if predicted from family histories, may be minimized through early adaptation of diet, lifestyle, and medical treatment.

Goal: To recognize different modes of inheritance and the way they may affect an offspring's health.

Key Concept 5: Genetic disorders and birth defects may be transmitted in several different ways.

Focus 1: Some genetic conditions are a result of chromosome abnormalities.


how Dominant inheritance works
One affected parent has a single faulty gene (D) which dominates its normal counterpart (n).
Affected Father
Normal Mother
Dn
nn
Dn
nn
Dn
nn
Affected
Normal
Affected
Normal
Each child's chances of inheriting either the D or the n from the affected parent are 50%.
how Recessive inheritance works
Both parents, usually unaffected, carry a normal gene (N) which takes precedence over its faulty recessive counterpart (r).
Carrier Father
Carrier Mother
Nr
Nr
NN
Nr
Nr
rr
Normal
Carrier
Carrier
Affected
The odds for each child are:
1. a 25% risk of inheriting a "double dose" of r genes which may cause a serious birth defect
2. a 25% chance of inheriting two Ns, thus being unaffected
3. a 50% chance of being a carrier as both parents are

SUGGESTED INFORMATION:

- Chromosome abnormalities are the probable cause of 36-40 percent of all spontaneous abortions. Significant chromosomal abnormalities occur in approximately one of every 150-250 live births. At least three-quarters of them are detrimental.
- Since chromosomes, which carry many thousands of genes, are a major determinant of inherited characteristics, even the slightest chromosome abnormality involves scores of genes and can cause severe developmental problems in a fetus. During the cell division process, chromosomes may divide in abnormal ways that result in more or less chromosome material in each new cell than is normal.
- Many factors contribute to chromosomal errors but little is known about specific causes of common syndromes. Medical geneticists have speculated that

such environmental factors as radiation and drugs may contribute to these defects. Viral diseases are known to relate to some chromosome damage. The mother's age is known to be related to higher incidences of Down syndrome.

• Down syndrome is probably the best known autosome disorder. There are three types:

—*Trisomy* (nondisjunctional) is the presence of an extra chromosome #21 in all cells. By far the most common form (95 percent of all cases), trisomy is *much likelier to affect a baby that is born to a woman in her late 30s or 40s. It is considered accidental and is not transmitted in families.*

—*Translocation* is rare (4 percent). It is caused by the presence of extra chromosome #21 material becoming attached to another chromosome in all cells. Maternal age is not a factor, but *a parent may be a carrier.* Then there is a 50 percent chance of producing a child who will be a carrier and a high chance of producing a Down syndrome child (about 10-15 percent if mother is a carrier and 5 percent if father is a carrier).

—*Mosaicism* also rare (1 percent), is a mixture of trisomic and normal cells in an individual. *It is not inherited* and may cause milder symptoms than the other two.

—Predicting before conception for translocation-chomosomes and during pregnancy for Down syndrome in the fetus is usually possible. (See Key Concept 6, Focus 2.)

• Other chromosome disorders include: Turner's syndrome (female) and Klinefelter syndrome (male) that result in sexual underdevelopment, growth abnormalities, and mental deficiencies. They are caused by a lack (in females) and overabundance (in males) of the *x* (sex) chromosome (3, 11, 12, 21, 27).

Focus 2: Some genetic conditions and birth defects are a result of single-gene defects: dominant inheritance, recessive inheritance, or *x*-linked inheritance.

SUGGESTED INFORMATION:

• Dominant single-gene defects:

—Transmitted by one affected parent.

—Each pregnancy involves 50 percent risk if one parent is affected, 75 percent risk if both parents are affected.

—Examples of dominant single-gene defects include:

1. Achondroplasea, a form of dwarfism
2. Some types of glaucoma, an eye disorder that can lead to blindness
3. Huntington disease, a degenerative neurological disorder
4. Hyperlipidemia, a cause of artery disease
5. Polydactyl, extra fingers or toes

• Recessive single-gene defect:

—Each parent must carry the recessive gene.

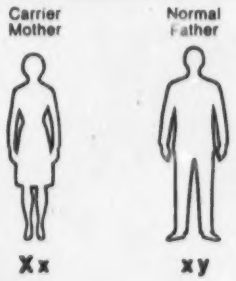
—There is a 25 percent chance in each pregnancy of producing an affected child.

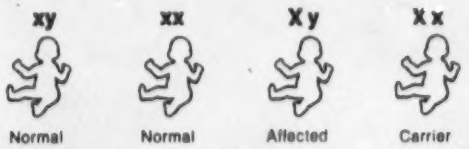
—Examples of recessive single-gene defect include:

1. Tay-Sachs disease, a degenerative neurological disorder leading to death in children. Its target population is largely Ashkenazi Jews.
2. Sickle cell anemia, a blood disorder mainly affecting West African Blacks.
3. Phenylketonuria (PKU), inability to metabolize a certain amino acid affecting Northern European Caucasians and Orientals.
4. Cystic Fibrosis, an endocrine, pancreatic, and respiratory illness that is the most prevalent of these disorders among Caucasians.
5. Thalassemia, a blood disease resulting in anemia—prevalent in the Mediterranean region, especially Greeks, Italians, but also affecting Africans, Indians, and Chinese.

how X-linked inheritance works

In the most common form, the female sex chromosome of an unaffected mother carries one faulty gene (**X**) and one normal one (**x**). The father has normal male x and y chromosome complement.





The odds for each *male* child are 50/50:
1. 50% risk of inheriting the faulty **X** and the disorder
2. 50% chance of inheriting normal x and y chromosomes

For each *female* child, the odds are:
1. 50% risk of inheriting one faulty **X**, to be a carrier like mother
2. 50% chance of inheriting no faulty gene

• Sex-linked (*x*-linked) conditions:

—Only the *x* chromosome carries these defects. The father can only pass his *x* chromosomes to his daughters, never to his sons who get the *y* chromosome.

—The female is always the carrier of *x*-linked conditions.

—The carrier mother herself is not affected by the disorder. (If, in extremely rare cases, the female has two affected *x*-chromosomes, she will be affected by the disease herself.)

—Because the carrier mother has one normal and one abnormal gene on her sex chromosome, there is a 50 percent risk each male child will be affected by the disorder and 50 percent risk that each female child will be a carrier.

—Examples of sex-linked disorders include:

1. Hemophilia, difficulty with blood clotting.

2. Muscular dystrophy — Duchenne type, impaired voluntary muscular function.
3. Lesch-Nyhan syndrome, mental retardation, compulsive self-mutilation behavior, uremia (8, 23, 27).

Focus 3: Genetic diseases may be a result of multi-gene inheritance or interaction of multi-genes and environmental factors.

SUGGESTED INFORMATION:

• Most normal growth and development depends on normal products of a number of genes rather than any single gene. For instance, height, intelligence (brain function), skin color, and processes of metabolism each depend on the influence of groups of genes rather than any single gene.

• Many human afflictions that have a hereditary basis involve multi-genes or interaction between multi-genes and environment. If any one or more genes in any group are abnormal, multi-gene defects and diseases may occur. These include club foot, congenital dislocation of the hip, spina bifida, certain forms of diabetes, and some forms of hydrocephalus. Multiple genes act in complex ways to cause these numerous disorders. At this stage genetic understanding about actions of genes and method of transmission are not clear.

• Environment may also affect development. For instance, intelligence depends to a great degree on brain function which, as a biological process, is considered to be genetically influenced by multi-genes. However, the condition of the hemoglobin, circulation, oxygen supply and skull size will also influence brain function and intelligence. Some of these may be caused by genes controlling various body systems that provide internal environment or be a result of other environmental factors such a nutrition or drugs.

• In some cases, multifactorial processes (as well as single genes) are suspected of creating greater susceptibility to environmental factors which then leads to a disorder. These may include allergies, atherosclerosis, hypertension, certain kinds of cancer, certain mental illnesses, nonspecific mental retardation, peptic ulcer, and kidney stone disease.

• Premature birth, while not a structural defect in itself, may be caused by multifactors and can lead to serious multifactorial disorders (2, 3, 23, 27).

Goal: To recognize that the ability to prevent, predict, diagnose, or treat some genetic disorders is relevant to responsible decisions about childbearing.

Key Concept 6: Some genetic disorders and diseases can be prevented, predicted, diagnosed, or treated.

Focus 1: There are several ways to predict or diagnose genetic disorders and diseases.

SUGGESTED INFORMATION:

• Predictions:

—The fairly recent emphasis in research on genetic disorders is resulting in increased ability to predict as well as diagnose many genetic disorders. However, at this time predictions before conception, even when carriers of disorders are identified, are limited to mathematical estimates of the probability that offspring may be affected. For instance, prospective parents may be alerted to their being carriers of translocation chromosomers (resulting in Down syndrome) if they have had one affected child, if close relatives have had affected children, or if there has been a high incidence of miscarriages. If tests prove they carry translocation chromosomes, the prognosis of the disease occurring in offspring is based on mathematical estimates: 50 percent chance of producing a carrier and a high risk (10-15 percent if mother is carrier and 5 percent if father is carrier) of having an affected child.

—Predicting the possibility and probability of some genetic disorders appearing in future offspring may occur through:

1. Family histories (pedigrees)
2. An expanding ability to identify carriers of some disorders
3. Screening of certain high risk populations for genetic traits or diseases
4. Genetic disorders present in previous offspring
5. Prospective mother's age (especially Down syndrome) (27).

• Family histories (pedigrees):

—Family histories (including extended family members where possible), are helpful in predicting and diagnosing genetic disorders. Doctors have traditionally asked basic family history questions to assist in their medical diagnosis of patients' illnesses. Now, as genetic knowledge indicates that many more diseases have a genetic or familial base, families are being encouraged to develop family health histories to: (1) assist future gen-

erations; (2) predict and diagnose genetic disorders; (3) assist prospective parents in family planning; and (4) diagnose genetic diseases before and after birth of a child.

• Family histories should include any major or chronic illness or defect. Examples of the information that should be in family health histories are:

—Asthma, arthritis, allergies, alcoholism

—Blood diseases (hemophilia, sickle cell disease or trait, thalassemia)

—Heart diseases (high blood pressure, atherosclerosis, hyperlipidemia, stroke, congenital heart defects, heart attack)

—Metabolic diseases (PKU, Tay-Sachs disease, diabetes, galactosemia)

—Functional/structural defects (cystic fibrosis, muscular dystrophy, Down syndrome, visual/hearing defects)

—Markedly low birthweight/prematurity

—Mental disorders (schizophrenia, mental retardation, depression)

—Reproductive history (miscarriages, stillbirths, inability to conceive).

• Prenatal diagnosis:

—It is possible to detect and diagnose some genetic conditions in prenatal stages through amniocentesis, ultrasound, fetoscopy, and other tests.

—*Amniocentesis* is a process by which amniotic fluid is withdrawn from the amniotic sac by way of a needle inserted through a pregnant woman's abdomen. This can be done as early as the fourteenth week of pregnancy. Cells from the fluid will be grown in cultures that can be analyzed for their chromosomal content. There are numerous tests that can be made but only tests for conditions that present a high risk for the fetus are performed.

—Amniocentesis is performed by professional medical specialists. After an element of risk of genetic disorder has been identified, conferences between medical specialists and expectant parents will inform them about the process and the kind of information they can expect to receive. Based on this information the at-risk parents then decide whether or not to proceed with amniocentesis. Genetic counseling to interpret results and outline options for parents to consider is important before and after test results are available. For instance, chromosome abnormalities can be detected in a fetus through amniocentesis and tests on fetal cells during the early part of the second trimester of pregnancy. However, only those women who are at risk will be alerted to the possibility of taking these tests. They usually are pregnant women over 35 years of age, mothers of any age who have already had one offspring with chromosome disorders, and translocation carriers.

—*Ultrasound* is a test that uses high frequency sound waves to locate the position and note the size and structure of the fetus and placenta in the womb. This is particularly valuable in diagnosis of multiple births where prematurity can be a problem. Ultrasound is also used to help guide needle insertion in amniocentesis.

—*Fetoscopy*, insertion of a viewing instrument directly into the womb to observe the fetus and take blood samples is sometimes used for diagnosis of otherwise undetectable blood diseases and malformations. This method is still experimental and available at only a few major medical centers but holds promise for the future (3, 10, 15, 17).

• Diagnosis after birth:

—Blood tests are mandated in many states for PKU and other metabolic diseases that can be treated to prevent serious disorders.

—Physical examinations and APGAR scores given immediately after birth and at intervals thereafter give an overall view of a newborn's condition and functions, alerting medical staff to possible genetic and other disorders.

—Pediatricians and medical advisors plus parents need to be aware of symptoms that indicate late developing disorders.

—Parents whose family history indicates their children may be at risk of late-appearing chronic disorders can help their children develop nutrition and lifestyle habits from earliest childhood that may prevent or minimize a disorder's effects (8, 26, 27) (See Nutrition and Environment chapters).

Focus 2: Some genetic disorders and diseases can be prevented or treated.

SUGGESTED INFORMATION:

• Continuing research has created progress in developing ways of preventing or treating many defects that once caused serious consequences.

• Early and regular medical care during pregnancy is vital to protect against environmentally caused problems, but also for predicting and treating some genetic disorders.

"Relatively few birth defects can be completely corrected but many can be treated to slow, stop, or partly reverse harmful effects."

• Prevention at this time is possible in a limited number of disorders. One example is in RH incompatibility. RH vaccine, when administered within 72 hours after birth of a first child (usually unaffected), will prevent antibodies from developing in the mother's body which would damage future children. Sometimes this vaccine is given in the latter part of the first pregnancy if signs indicate antibodies may be forming earlier. In cases of miscarriage or abortion, mini-doses are given at the time of pregnancy's termination. If vaccine is not administered in time and antibodies are allowed to form, future offspring will be endangered (1).

(Note: Immunization against rubella, an infectious disease, can prevent the devastating effects the disease has on an unborn child. See Environment chapter.)

• Treatment. Relatively few birth defects can be completely corrected but many can be treated to slow, stop, or partly reverse harmful effects. Available kinds of treatment include:

—*Corrective surgery* for structural defects such as cleft lip and palate, clubfoot, various heart malformations, crossed eyes, bowel obstruction, shunting for hydrocephaly (sometimes in utero), and many others.

—*Chemical regulation* by drugs, hormones, vitamins, and dietary supplementation or restriction. Examples are insulin and diet for diabetes, phosphate and vitamin D metabolites for inherited rickets, protein substitute for PKU, growth hormone for dwarfism, blood plasma for hemophilia. An encouraging discovery, a new diet that seems to help remediate mental retardation in children with Down syndrome, is in the testing stage.

• *Prostheses,* such as hearing aids, artificial hands, eyeglasses, and other mechanical devices.

• *Transplants* of corneas, kidneys, and bone marrow for immuno-deficiency disorders. Polystic renal disease and Thalassemia are helped by transplants.

• An exciting potential for prenatal diagnosis lies in treatment of certain inherited metabolic defects before birth. Inborn errors of body chemistry account for more than 125 known birth defects and there may be many more. One child afflicted with such a metabolic defect is thriving today, the first baby ever treated successfully before birth. Future hopes include replacement of missing enzymes and cell transplantation or modification to save victims of these disorders (3, 20).

Focus 3: Medical and genetic counseling can assist prospective parents to identify their genetic status and the variety of options available to them.

SUGGESTED INFORMATION:

• A growing number of institutions provide the services of trained genetic counselors to concerned prospective or expectant parents who suspect they are at risk of having a child with congenital malformations or genetic disorders. Usually the family medical advisor will refer at-risk patients to medical facilities providing these services.

• For some disorders, testing may be done prior to conception to determine the prospective parents' status as "carriers" of the disorder. Some adults who have a disorder themselves may not need a test but will want counseling about options for decisions about becoming parents.

• After testing and analysis of family health histories, a genetic counselor can interpret findings and list available options. Counseling helps prospective parents consider alternatives as they relate to family circumstances and their values. A genetic counselor provides information and counseling. Decisions are always the responsibility of prospective parents (9, 16, 18).

Note To Educators:

• Since options include some that are heavily weighted with ethical, moral, and emotional implications, there are some strong currents of controversy about genetic testing and counseling. Each individual and couple will have to evaluate personal, family, religious, and cultural values to find options that best meet their needs. Care should be taken to develop curriculum content and teaching strategies that will alert teachers to the sensitivity of these issues so that an individual's personal and family values are protected.

• The study of bioethics and related decision making seems essential to this and future generations. Young people need to be aware that, as genetic knowledge increases ability to diagnose genetic conditions and even to manipulate hereditary factors, they may face decisions that deeply involve their ethical and moral values.

Special problem-solving skills, based on analysis of values that influence decision making, will be essential to generations living with these new capabilities (16).

"After testing and analysis of family health histories, a genetic counselor can interpret findings and list available options."

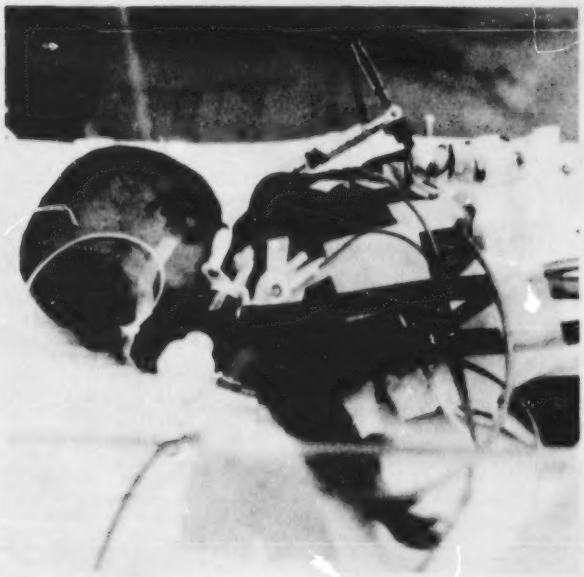
Goal: Recognize the increasing responsibility that genetic conditions are placing on each person as an individual, prospective parent, member of a family, and as a citizen.

Key Concept 7: Individuals and society face psychological, economic, and ethical consequences caused by genetic conditions and the medical advances being made to identify and treat them.

Focus 1: Everyone should be helped to appreciate unique qualities in self and others and to fully develop individual potential in spite of or because of inherited characteristics.

SUGGESTED INFORMATION:

• Each person is unique because of heredity and important as an individual human being. Each person should be helped to accept genetic conditions or disorders as constituting only part of a total individual.



- The unknown is usually more threatening than the familiar. Mainstreaming youngsters with handicaps in schools, a controversial and not necessarily successful move, seems to be a step toward providing a degree of familiarity to reduce fear of the unknown as well as offering an affected person more normal opportunities for social interaction.
- More disabled children and adults are actively engaged in the work force and schools and are influencing society to provide access to work and recreation facilities.
- The Special Olympics, another controversial move, with their focus on cooperative effort between affected and unaffected persons and the joy of participation have attempted to establish more relaxed acceptance of individuals for their positive human attributes.
- A number of adoption agencies and associations indicate a growing acceptance among prospective adoptive parents for infants and children with disabilities.
- Each child needs to recognize and use his/her own strengths and view personal problem areas as a challenge to be met. This may help them relate better to children with special challenges.

Focus 2: Some genetic disorders can cause physical, emotional, and economic stress that can result in both positive and negative consequences for individuals and families.

SUGGESTED INFORMATION:

- Time and energy in great quantities may be required of family members to provide special personal, medical, and educational services needed by a genetically affected child, often at the expense of other family members.
- Special medical, educational, or institutional care can create an economic drain on the family that may last for the parents' lifetime and beyond. For example, cystic fibrosis treatment for the child who lives at home may take as much as three or four hours of therapeutic treatment daily and cost approximately $10,000 a year, a heavy burden for most families. Please note: This example is for background information only. Great care should be taken to use examples that will not offend or hurt children in class.
- Emotional stress can arise from concern about the disabled child, reactions of siblings who feel less well cared for, attitudes of friends and acquaintances, misplaced guilt because the disorder was genetically transmitted, worry that future children may be affected, changes in the relationship between husband and wife.
- On the other hand, family members may feel a sense of fulfillment from helping their loved one, develop special depths to relationships within the family, learn ways to adapt to special circumstances, appreciate those positive capabilities that emerge when others are denied, and feel needed.
- Regardless of benefits and costs, caring for a genetically disordered child creates many demands on family members and a special lifestyle.

Focus 3: Some genetic conditions can be costly to society.

SUGGESTED INFORMATION:

- The cost of providing institutional care for disabled children who require constant care, special education either in regular school classes or in special classes and schools, medical treatment or surgical corrections of defects, are often too great a financial as well as physical and emotional burden for families to handle alone.
- Local, state, and federal agencies, both public and private, have arisen to assist in these support systems.
- Research for causes and cures requires great quantities of money. Some research is publicly sponsored, some is private.
- Everyone supports these systems through taxes and may contribute to private agencies.
- Informed citizens are vital to:

—Support genetic research and education

—Cooperate and volunteer to assist affected individuals, families, and supportive agencies in the community

—Support legislation to provide essential services (8, 13, 14, 19, 27).

Focus 4: Advances in genetic medicine have raised important ethical questions.

SUGGESTED INFORMATION:

- Recent discoveries and technological advances in human genetics best exemplified by prenatal diagnosis and detection of carriers have created controversy affecting families and society.

—At-risk families face ethical decisions about whether or not to have a child.

—Once conception occurs, for some disorders, parents may have the option of a prenatal test to determine if a fetus is affected.

—Societal and religious values may clash as they

Note To Educators:

These ethical questions are not simple to analyze. There is a need for special decision-making/problem-solving processes and skills. Some universities are offering special advanced studies in bioethics that address these kinds of concerns. At least one university offers workshops for teachers and junior and senior high school students in bioethical aspects of decision making (16).

Since the concerns are sensitive ones, great care should be taken to protect the beliefs and rights of each individual and family. Teachers should not feel they have to assume the sole responsibility for the discussions and information. A representative balance from among the local community's religious and lay leadership is essential. Special training for teachers is important to make them aware of the skills involved in conducting discussions about sensitive, value-laden, and complex ethical issues.

weigh the options available should the tests show the fetus is affected.

• Advances in genetic medicine offer critical ethical challenges to society. These challenges may include:

—When does human life begin? How does this affect the options available to the expectant parents when a genetically affected child is diagnosed?

—Since sex of a fetus can be determined before birth, should parents have a right to exercise any available option if a child is not the sex they prefer? What impact could this have on society?

—Is there a possibility that society may require use of genetics to improve the human species through selective breeding, artificial insemination, prescription of fit and unfit parents?

—The ability to create a new form of bacterial life through gene/DNA manipulation is a reality and a patent has been given to the discoverer. What ethical implications does this have?

—Can a child born with genetic disabilities that could have been determined before birth sue the parents for allowing birth to occur?

—How far should medical support be given to sustain a newborn with severe disabilities? (16, 17)

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Human Growth and Development Concept Chart.

The following chart keys into concepts expressed in the Human Growth and Development chapter.

		Pre-school through Kinder-garten	Primary	Upper Elemen-tary	Middle/ Junior High	Senior High
KEY CONCEPT 1:	Physical, intellectual, and emotional development occurs in an expected sequence of stages but the timing of the stages is still a unique process.					
Focus 1:	Human development (physical, intellectual, and emotional) proceeds along a set of sequenced steps or stages.	Ⓐ	Ⓐ	●	○	○
Focus 2:	Stages of development, influenced by interaction of heredity and environment, are expressed in ways unique to each individual.	Ⓐ	Ⓐ	●	○	○
Focus 3:	Knowledge of human growth and development provides young people with insight to realize their own developmental potential and that of any children they may have.		Ⓐ	●	○	○
KEY CONCEPT 2:	Certain stages of development are especially important to responsible childbearing and prevention of birth defects.					
Focus 1:	**Prenatal Stage.** Particular periods in the prenatal stage have special importance to physical and mental development of a baby.			Ⓐ	●	○
Focus 2:	**The Infant.** Throughout the first year of life the infant is almost totally dependent on parents or others to provide the physical, intellectual, emotional, and social necessities for growth and development.		Ⓐ	Ⓐ	●	○
Focus 3:	**Adolescence** is a developmental stage that brings physical and emotional changes in self-concept, sexual attitudes and roles, and relationships with parents and peers.			Ⓐ	●	○

KEY TO SYMBOLS:

Ⓐ—Awareness. Concept can be introduced (with limited and appropriate examples) as it relates to science, social studies, or general observation of the human condition, and so on without going into the details of the content.

●—Concept can be expanded with enough detail to clarify cause and effect and the role this information plays in each person's life.

○—In-depth instruction of concepts taught at previous levels with expanded decision making, assessment of social impact, application to real problems.

Human Growth and Development Concept Chart. (continued)		Pre-school through Kinder-garten	Primary	Upper Elemen-tary	Middle/ Junior High	Senior High
Focus 4:	Although adolescent physical changes in both boys and girls are predictable, they may vary in time and degree.			Ⓐ	●	○
Focus 5:	Human reproduction is the result of sexual intercourse and is physically possible after the onset of menses in the female and early in male puberty.			Ⓐ	●	○
Focus 6:	During adolescence physical changes that make sexual reproduction possible may occur before emotional, intellectual, and social development provides the ability to accept personal responsibility or make realistic plans for the future.			Ⓐ	●	○
Focus 7:	Physical ability to reproduce occurs at an age when educational, economic, and social systems are not usually supportive of parenthood.			Ⓐ	●	○
Focus 8:	Both the male and female parents have a responsibility to offer a baby the best chance of being healthy, well-developed, and cared for after birth.			Ⓐ	●	○
KEY CONCEPT 3:	The major body systems interact to determine a pregnant woman's ability to support growth and development of a fetus.					
Focus 1:	The major systems of the body are interdependent yet perform specialized functions to support health, growth, and energy.	Ⓐ	Ⓐ	●	○	○
KEY CONCEPT 4:	There are physical, intellectual, and emotional needs basic to health and well-being that affect human behavior and decisions about childbearing.					

KEY TO SYMBOLS:

Ⓐ—Awareness. Concept can be introduced (with limited and appropriate examples) as it relates to science, social studies, or general observation of the human condition, and so on without going into the details of the content.

●—Concept can be expanded with enough detail to clarify cause and effect and the role this information plays in each person's life.

○—In-depth instruction of concepts taught at previous levels with expanded decision making, assessment of social impact, application to real problems.

Human Growth and Development Concept Chart. (continued)		Pre-school through Kinder-garten	Primary	Upper Elemen-tary	Middle/ Junior High	Senior High
Focus 1:	The degree to which physical needs of nutrition, exercise, sleep, and rest are met determines the body's functions, as well as intellectual development and emotional stability.	Ⓐ	Ⓐ	●	○	○
Focus 2:	Stimulation and challenge influence the development of intellectual abilities in the infant, child, and adult.			Ⓐ	Ⓐ	●
Focus 3:	Humans strive toward common emotional and psychological needs in ways that affect behavior and childbearing decisions.	Ⓐ		Ⓐ	●	○
Focus 4:	Each person should realistically assess personal needs and expectations in relation to decisions about having a child.				Ⓐ	●

KEY TO SYMBOLS:

Ⓐ—Awareness. Concept can be introduced (with limited and appropriate examples) as it relates to science, social studies, or general observation of the human condition, and so on, without going into the details of the content.

●—Concept can be expanded with enough detail to clarify cause and effect and the role this information plays in each person's life.

○—In-depth instruction of concepts taught at previous levels with expanded decision making, assessment of social impact, application to real problems.

Human Growth and Development

Goal: To understand that stages of human development and growth have identifiable characteristics, and knowledge of those characteristics enables individuals to anticipate and accommodate their needs and those of any children they may have.

Key Concept 1: Physical, intellectual, and emotional development occurs in an expected sequence of stages but the timing of the stages is still a unique process.

Focus 1: Human development (physical, intellectual, and emotional) proceeds along a set of sequenced steps or stages.

SUGGESTED INFORMATION:

- Boys and girls can be helped to recognize identifiable characteristics of the present stage, a past stage, and anticipate those of future stages.
- Recognizing progression from dependency (fetus, newborn) toward independence (child, adolescent, young adult) may help young people feel comfortable about their own developmental status and understand some of the requirements and roles that parents must assume when their children are in these stages.
- Knowing stage sequence can help young people view their own sexual maturation as a logical and anticipated development.

Focus 2: Stages of development, influenced by interaction of heredity and environment, are expressed in ways unique to each individual.

SUGGESTED INFORMATION:

- Heredity sets expected ranges and development within these limits is influenced by the environment. This accounts for differences in height, muscular development, coordination, emotional maturity, and intellectual development among youngsters of similar ages. For instance, it is predictable that girls will grow taller earlier in puberty than boys. However, each girl is not going to grow to the same height because heredity, influenced by environment, controls the degree of development.
- Similarly, development of physical, emotional, social traits, and sexual maturity will occur at different times and to different degrees among both boys and girls.
- It may help reassure youngsters who develop earlier or later than others to understand that differences in timing are normal, especially when secondary sexual characteristics are involved. Young people need to appreciate the value of being different as well as being like others in order to develop a positive sense of their own worth and to recognize value in others.

Focus 3: Knowledge of human growth and development provides young people with insight to realize their own developmental potential and that of any children they may have.

SUGGESTED INFORMATION:

- Knowledge of developmental characteristics encourages responsible decisions. For example:
  - —With knowledge about the periods of greatest physical growth, individuals can choose the kind and quantity of nutrition needed to support that growth
  - —Understanding intellectual growth stages, parents can choose stimulation and challenges a child needs and can handle
  - —With awareness of emotional changes young people may be reassured and comforted as they adjust to new roles, and make responsible sexual decisions
  - —Learning to cope with and enjoy themselves as positive persons during puberty can enhance responsible decision making.

Goal: To recognize aspects that affect responsible decisions about childbearing: prenatal stages, first year of infancy, adolescence, and certain maternal developmental stages.

Key 2: Certain stages of development are especially important to responsible childbearing and prevention of birth defects.

Focus 1: Prenatal Stage. Particular periods in the prenatal stage have special importance to physical and mental development of a baby.

SUGGESTED INFORMATION:

• Various aspects of fetal development are discussed both in the Environmental and Genetics chapters. It is included here as the essential beginning human developmental stage. Even young learners may be fascinated by these developments. There are several reasons for teaching the fascinating week-by-week development of a fetus:

—Fetal growth illustrates predictable aspects of a developmental stage in a compact and dramatic way

—It illustrates the effects that interaction of heredity and environment exert on a developmental stage

—Most important to the focus of this project, it informs prospective parents about nutritional and protective support that certain fetal stages require, and indicates periods of special vulnerability to injury from environmental sources.

• The first trimester (12 weeks) illustrates:

—Body parts and organs are in the vulnerable stage of formation and may be seriously, even permanently, injured by disease, harmful substances, and poor supply of nutrients

—How the formation and function of the umbilical cord and placenta operate to channel nutrients and other substances ingested by a mother to the fetus for both positive and negative results. (See Environmental chapter.)

• The second and third trimesters (12 weeks to birth) illustrate:

—Step by step progression of the organs and systems of the body as they mature enough to support life after birth. For instance, as early as 18-20 weeks a heartbeat can be heard; the fetus can kick, cry, suck its thumb, and exercise by moving freely in its protective bag of amniotic fluid

—The importance of care (nutrition and protection from harmful substances and disease) to encourage a full-term, full-weight baby. For instance, the brain grows rapidly during the last 12 weeks, the lungs fully develop during the last four-six weeks, fat forms to protect the infant from temperature changes and other environmental conditions after birth. The fetus gains 90 percent of its weight during the last 20 weeks, and doubles its weight in the last six weeks. Immune systems form to protect the infant from diseases after birth. (See Environmental chapter) (4, 6, 20).

—**NOTE:** A woman faces predictable emotional and physical stages during pregnancy. Also, an expectant father can anticipate some emotional adjustments. A complete curriculum to educate for parenthood should include those phases.

• Labor, delivery, and birth. It is good for the expectant mother and father to understand stages of labor and delivery. If she understands, the mother can support the process and sustain her strength. With the

father's help she can practice certain techniques and exercises that prepare her body for labor and delivery.

• Understanding different birthing methods, parents can choose the degree of participation each prefers, discuss with their medical advisor delivery methods to minimize birth trauma for their infant, and provide that emergency medical care is available. Certain tests should be made soon after birth to identify genetic or other diseases so that preventive treatment can be started (See Genetics and Environmental chapters).

Focus 2: The Infant. Throughout the first year of life the infant is almost totally dependent on the parents or others to provide the physical, intellectual, emotional, and social necessities for growth and development.

SUGGESTED INFORMATION:

• Parents or primary care givers are extremely important during these months, not only to provide food, care, and protection, but also stimulation, love, and attention that make the infant feel secure and help it learn that change and new experiences are happy experiences.

• The infant stage of development illustrates:

—The kinds and degrees of responsibility required of parents during the time of a child's total dependency

—Infant development is greatly influenced by the kind of nurture it receives

—Parents need to be alert for conditions that may need early diagnosis so that corrective treatment can be started

—Parents need to develop realistic expectations for their children (5, 8).

• There are predictable stages to the development of each category, but degree of development will differ according to environmental factors and the stimulus each receives.

• *Physical development* (height, weight, proportion, muscle development, and coordination). In the infant, first movement is random and uncoordinated, except for such organized reflexes as rooting, sucking, and grasping. The child kicks, wriggles, and flails. Gradually, coordination develops and a child moves through the stages of turning over, sitting, standing, and also develops increased coordination of small muscles for focused sight and finger-thumb grasping. Parents need to eliminate constricting clothing, provide a safe area for physical exploration, and show warm approval as the infant explores new movement of body parts (11, 13, 31).

• *Intellectual development* (thinking, language development). Intellectual development requires sensory stimulation and motor exploration. A store of how things taste, smell, feel, work, and fit together must accumulate before thinking, problem solving, and language can occur. There is a sequence to language development from crying to babbling to syllable sounds. Development of language is essential to human functioning and handling of abstract ideas. Parents need to talk to their babies as well as offer sensory stimulation

to facilitate intellectual growth. Infants need to see color, movement, shapes, hear sounds and language, taste, touch, and explore through action. Deprived of stimulation, intelligence fails to develop, may never fully develop, and in extreme cases, an infant may even fail to survive. Parents need to provide an uncluttered yet stimulating sensory environment, play games, talk, sing, show approval and pleasure as the infant responds to new environmental challenges (3, 11, 12, 13, 14, 31).

• *Emotional development* (love, trust, responses to positive and negative stimuli). Infants thrive in an environment of love, understanding, and care. They feel safe and secure as their needs are met. This develops a sense of goodness about self—the beginning of self-esteem, a necessary aspect for development of autonomy and relationships with other people.

Emotions begin as a response to tactile stimulation. Babies cry and squirm when they are cold, wet, or hear loud noises, and they generally relax their bodies with cuddling, rocking, warmth, and food. Within the first year they begin to differentiate responses into more specific emotions of joy, curiosity, anger, fear, disgust.

—Love is psychologically essential. A child deprived of love may suffer delayed physical, intellectual, and social development as well as retarded emotional growth. Need for love is so great that some psychologists and sociologists suggest an infant might die without it. The only way an infant knows it is loved is if the parents touch, hold, rock and cuddle their baby, and make reassuring, loving sounds.

—Infants learn to trust because they have received affection and gratification of their needs. They learn distrust because of abuse, neglect, or deprivation. Trust is essential to establishing healthy relationships with others (3, 10, 31).

• Socialization (learning about other people, relationships, rules, and role behaviors).

—Infants perceive everyone and everything in the environment as an extension of themselves. Gradually they identify separate individuals and differentiate between familiar and unfamiliar. Then infants learn to express behaviors appropriate to certain people and situations.

—Social behavior may begin with a smile in response to others. The two- to five-month old baby may express pleasure by kicking, smiling, and waving arms, recognize familiar faces, make cooing noises. Later babies begin to express social behavior; they lift arms to be picked up, laugh, chuckle, and squeal during games and play. Soon infants may develop signs of distress at seeing strangers; this may become anxiety at being separated from primary care givers. This anxiety is a sign of normal maturity. Developing security in social interaction occurs best when an infant does so from a safe environment of love and trust (13, 17, 31).

• Motivation and behavior.

—Infant motivations are based entirely on needs. Babies may cry to indicate pain, discomfort, fatigue, sickness, hunger, or loneliness. Infants are not motivated by revenge, power, guilt, or desire to inflict pain on another. Parents need to realize this when responding to infant behavior.

—Caring for the infant needs, diverting a baby's attention from unsatisfactory or dangerous activities, showing approval of positive responses rather than punishment for negative ones will help an infant develop an awareness of approved behavior (31).

• Parents are required to perform a very demanding set of tasks during this first year. They need stamina, commitment, and sense of humor. Often they will have to forego their own needs to provide for a dependent and demanding infant. The baby's dependence can be both rewarding and difficult for parents, and young people need to know that.

• Health condition and defects not observable at birth may show up during the first year.

—The sections on genetics, nutrition, and environment refer to some of these factors and defects. Parents and medical advisors need to share genetic and environmental information to ensure proper diagnosis and early treatment for these disorders.

—In some cases parents have to be alert to abnormal conditions that may not be obvious or anticipated. For instance, hearing loss may be overlooked unless the parent is alert for a lack of response to sounds and noises. This is an especially important loss to discover early because language development is dependent on hearing during the first years. Symptoms of vision impairment, problems with motor control, and mental retardation may appear. Early diagnosis allows for alternate approaches to learning and development to minimize loss to self-esteem.

—Early and periodic health care is essential during the first year, not only for identification of developmental problems, but to provide proper immunization programs. Many serious infectious diseases—such as diphtheria, whooping cough, typhoid, and polio—are now preventable through immunization. Health agencies can provide information about recommended kinds and sequences of immunizations.

Focus 3: Adolescence is a developmental stage that brings physical and emotional changes in self-concept, sexual attitudes and roles, and relationships with parents and peers.

SUGGESTED INFORMATION:

• Developmental processes of sexual maturation create changes in emotional and social attitudes and behavior. The individual's self concept undergoes great change. Hormonal changes and emergence of secondary sexual characteristics cause a change in feelings and self-image. An adolescent vascillates between a desire for independence from parents and other adult authority and the security of that authority.

—Adolescents can be extremely self-focused. They are sensitive about their appearance and fluctuate between self-confidence and insecurity, especially in their relationships with members of the opposite sex.

—Peers carry the greatest weight in decisions about actions, beliefs, and lifestyle. Much self-esteem is based on the degree of peer acceptance adolescents crave.

—They may be fascinated by their body changes yet confused by the new feelings. Their reactions may be ambiguous towards their emerging sexual roles.

• Young people need to know that these normal aspects of a developmental stage are positive steps toward maturation and adulthood. Learning to differentiate between love, affection, and caring for another and the physical hormonal reactions to sensual/sexual stimuli may enable them to make responsible sexual decisions (4, 7, 15, 28).

Focus 4: Although adolescent physical changes in both boys and girls are predictable, they may vary in timing and degree.

SUGGESTED INFORMATION:

• Early, during the onset of puberty, both boys and girls should know the many changes that will occur making reproduction possible and also have the vocabulary to discuss these changes. For example:

—The development of major external and internal reproductive organs and their functions in the production of sperm (male) and eggs (female)

—The production of sperm and ejaculation in boys and ovulation and menstruation in girls

—Secondary signs of maturation often assume importance for the individual self-image. Examples are: (1) *boys*—voice changes; growth of body and facial hair; thickened, tougher skin; and growth spurts in height and weight; (2) *girls*—duct system and fat deposits to form breasts; broadening of pelvis; soft, smooth skin; more rounded figure; growth spurts in height and weight; and growth of body hair (15, 18, 28).

Focus 5: Human reproduction is the result of sexual intercourse and is physically possible after the onset of menses in the female and early in male puberty.

SUGGESTED INFORMATION:

• Every person on the verge of puberty should know:

—Sexual intercourse can result in pregnancy

—Any time even a small amount of semen containing sperm enters the vagina, pregnancy can occur

—Although young adolescents may consider sexual experiments a form of "playing" with their new interest and ability, the consequences are real

—That many young adolescents mistakenly think they are not old enough to cause pregnancy or get pregnant

—Some young pregnant girls didn't believe they were pregnant and viewed their condition as an illness unrelated to babies or the sexual act

—Sexual maturity may occur before emotional and intellectual maturity are developed adequately to sustain mature and lasting relationships necessary for responsible parenthood (2, 7, 9, 15, 27).

• Young people need to understand and have the vocabulary to discuss sexual intercourse, the process by which the sperm fertilizes an egg, and the attachment of a fertilized egg in the uterus. Myths and misconceptions about preventing pregnancy should be discussed and tested for accuracy. Some of these include: You can't get pregnant

—the first time you have intercourse

—before you're 15

—if you're not in love with your partner

—if you don't have an orgasm

—if you've had sex many times with the same person without getting pregnant

—if you douche

—if the male withdraws

—if you use certain positions (4, 28).

Focus 6: During adolescence physical changes that make sexual reproduction possible may occur before emotional, intellectual, and social development provides the ability to accept personal responsibility or make realistic plans for the future.

SUGGESTED INFORMATION:

• Adolescents should know they are dealing with: (1) stressful adjustments to physical changes, (2) emotional and psychological reactions to hormonal changes. In addition peer expectations often conflict with social and cultural constraints.

• A fluctuating self image makes responsible decisions about sexual behavior difficult and confusing. For instance, the girl may give sex in order to be loved or popular; the boy may feel the need to prove his new "manhood."

• A lonely teenage girl or boy may think having a baby is the solution for a need to feel loved or a need to love. A need for independence from childhood constraints can also be manifested in sexual relationships. This may happen before the intellect can reflect on the responsibilities and heavy consequences to lifestyle that accompany the 24-hour care of a baby. Sharing parenthood before a solid relationship has been established between two people may hinder rather than reinforce the relationship and adolescents should know that.

• To make responsible decisions about sexual behavior, a young adolescent, before puberty, needs to identify ways, other than sexual intercourse or untimely pregnancy, to satisfy basic needs for love, affection, independence, belonging, dignity, and respect (2, 7, 27, 28).

• Statistics indicate that once sexual intercourse is experienced young people seldom abandon it for other outlets for their sexual interests. It is estimated that nearly half of all 15-17-year-old males and one-third of comparable young women are sexually active. Even more alarming, 18 percent of boys and 6 percent of girls ages 13-14 have had intercourse. One-fifth of unwed teenage pregnancies occur within one month of the first sexual experience and one-half occur within six months. This indicates that education about responsible decision making concerning alternatives to sexual intercourse must be introduced before ages 12-13 (22).

• Young people need opportunities and assistance in searching for personal goals for the immediate future as well as for their adult life.

Note to educators:

• *Preventing Pregnancy*: The issue of whether or not to inform young people about contraceptives is a sensitive one in many communities and for many individuals. Certainly, *abstaining* from sexual activity should be emphasized with young adolescents as being the only sure method for preventing pregnancy. However, statistics indicate that sexual activity among young adolescents is increasing, and the choice between unwanted, untimely pregnancies and the use of contraceptives become a critical one for young persons, their families, and society (See Chapter 1).

• Information about ways to prevent unwanted pregnancies is basic to responsible childbearing. Educators need to work with parents and other community members in determining ways to reach all young people with this information. If young people are expected to make responsible decisions, they need accurate, factual information about alternatives so they can weigh the consequences of each against their personal, family, and cultural values. Schools share a responsibility with families and the community to provide that information. In fact, they may have to take the lead in promoting community and parent actions.

• In some instances, with the support of parents and the community, instruction will be given to students in school. For those students not receiving such instruction, educators, perhaps with the assistance of community health agencies, can develop instructional materials to be made available to parents for use with their youngsters. Certainly, schools should actively promote cooperation among all health and other community agencies in order to form a network of available sources to which adolescents and families can be referred for information and assistance.

• In any case, the school's role is to provide information in an unbiased, nonjudgmental, and factual manner so that benefits and dangers are evident. Decisions will be made by each individual according to personal, cultural, ethical, religious, and family values.

Focus 7: Physical ability to reproduce occurs at an age when educational, economic, and social systems are not usually supportive of parenthood.

SUGGESTED INFORMATION:

• Institutions of modern society are not structured to support adolescent pregnancy. Most jobs that pay a living wage require a high school education. Two-thirds of 1.1 million teenage mothers do not finish high

school; many young fathers drop out to support their new family. This often leads to a lifetime of low economic status, even welfare (29).

- Extended families may not be available to assist in childcare, and even the basic family unit of father and mother may be missing.
- Young adolescent mothers often find themselves as single parents coping with economic difficulties and personal stress in caring for a child. Sometimes the mother raises the baby in her parents' home. This provides some sharing of responsibility but may cause role conflicts. Parents may not be enthusiastic about assuming such a responsibility.
- The self-focus of young male and female adolescents often does not provide the best atmosphere for a baby and its needs. Usually the teenage parents are cut off from their peers and denied the social outlets of adolescence. Both boys and girls should give serious consideration to these consequences of pregnancy and parenthood during this time (7, 9, 28).

Focus 8: Both the male and female parents have a responsibility to offer a baby the best chance of being healthy, well developed, and cared for after birth.

SUGGESTED INFORMATION:

- Young adolescence is not the optimal stage for a healthy outcome of pregnancy.
  - —A higher incidence in premature or full-term, low birth weight babies (under 5 lbs., 6 oz.) are often associated with birth defects, disease, and failure to thrive or survive.
  - —These statistics may be caused by the lifestyle of some teenagers who are inadequately nourished or use drugs, medicines, alcohol, and tobacco.
  - —Adolescents often omit early and regular prenatal care, an essential element for healthy pregnancies. One-half of 203,000 teenage mothers (15-17 years old) received no prenatal care in the first trimester. One-eighth had no care until the last trimester.
  - —Modern technology can save even seriously injured or immature infants, some of whom will need special and extended medical, educational, and support care, for perhaps a lifetime. Prospective parents, especially young adolescents, must consider this responsibility and their ability to meet it (29, 32).
- Women over 35 (and the father) who plan to have children should consider the increased risk of birth defects. For instance, there is an increase in the incidence of Down syndrome as the age of the mother increases.
- The optimal developmental stage for becoming parents should be that which offers the minimum threat to infant health and provides for the emotional, economic, and social aspects of childrearing. The optimal period differs among individuals, cultures, and families. However, the period between ages 20-35 is a relatively stable time of physical and emotional development for the mother. The adolescent growth period is over, the hormone balance stabilized—making pregnancy safer for both mother and baby; social, educational, and economic conditions are usually better for supporting emotional and financial needs of a family. The mother and father are more likely to be past the self-focused stage, ready to commit time and energy to the demands of caring for each other, as well as a young child or children.
- Becoming a parent and participating in a child's development, though demanding, can also be a warm, rich, challenging, and loving experience. Care taken with timing and conditions of childrearing enhances rather than detracts from that experience (22, 23, 27).

Goal: To recognize the essential parts of the systems of the body, the role they play in maintaining body functions, and ways to safeguard their health to support pregnancy and the health of the fetus.

Key Concept 3: The major body systems interact to determine a pregnant woman's ability to support growth and development of a fetus.

Focus 1: The major systems of the body are interdependent yet perform specialized functions to support health, growth, and energy.

SUGGESTED INFORMATION:

- To care for their health and anticipate health needs of children, young people should know and understand:
  - —The major organs, their basic function and relationship to other systems, especially digestive, respiratory, circulatory, and nervous systems
  - —Health care and nutrient needs of body systems
  - —Elements that inhibit efficient functioning of body systems
  - —The ways the interdependence of the body's systems affect pregnancy (See Nutrition and Environment chapters).
- For instance:
  - —An inefficient heart, inelastic or clogged blood vessels, and faulty impulses from the nervous system to the heart affect the nutrition supply to fetus and mother, having serious effects on development and health. Nutrition, exercise, drugs, and disease have an impact on these conditions;
  - —Tobacco and marijuana smoke endanger the respiratory system. The smoke causes life threatening injury and diseases to respiratory organs, alway critical to fetal health.
  - —The nervous system-endocrine action affects the emotional and psychological feelings of the pregnant woman. In turn these affect her coping ability, eating habits, drug use, and other behavior important to fetal health. Nutrition, rest, exercise, drugs, disease—all influence the nervous system (21, 24).

Goal: To recognize the effect that the search to satisfy basic emotional, physical, and intellectual needs has on decisions about sexual activity and childbearing.

Key Concept 4: There are physical, intellectual, and emotional needs basic to health and well-being that affect human behavior and decisions about childbearing.

Focus 1: The degree to which physical needs of nutrition, exercise, sleep, and rest are met determines the body's ability to sustain physical functions, as well as intellectual development and emotional stability.

SUGGESTED INFORMATION:

- The human body depends on:

—Exercise to maintain muscle tone for all body functions, in particular the heart and circulatory system and the lungs and respiratory system. Two kinds of exercise are necessary: One that stretches, strengthens, and tones muscles to support body functions (lifting, stretching, bending, pulling); the other, sustained movement, vigorous enough to raise the pulse rate significantly, increase circulation, exercise the heart muscle and cardiovascular system, increase the blood vessel capacity, and increase lung capacity (running, walking, swimming, dancing). Both types are necessary on a regular basis for health. Exercise also affects reactions to stress, and emotional and psychological well-being.

—Sleep and rest to maintain general health and stabilize the nervous and endocrine systems which regulate intellectual and emotional functions.

—Inadequate, irregular sleep and rest impair intellectual, emotional, and physical functions.

- Young people need physical exertion, relaxation, and rest as aids for handling stress in everyday life. A direct physical relationship exists between chemical action in the body during stress and physical exertion that expends and reduces it.

- The degree to which these needs are met affects physical well-being, influences the way people think, and affects their behavior. Meeting these needs during pregnancy protects a baby's health and supports a mother's emotional well-being (24).

- Adequate nutrition provides energy, growth, and health for all body functions (See Nutrition and Environment chapters).

Focus 2: Stimulation and challenge influence the development of intellectual abilities in the infant, child, and adult.

SUGGESTED INFORMATION:

- Intellectual growth also develops through identifiable stages or sequences based on the maturation of the central nervous system and influenced by environmental factors of stimulation, challenge, and encouragement.

- Humans develop their intellectual abilities through mental stimulation and challenges. The number and

kinds of challenges influence the degree of development (See Key Concept 2, Focus 2). Lack of stimulation can seriously impair an infant's intellectual development, or for that matter, that of any age group.

Focus 3: Humans strive toward common emotional and psychological needs in ways that affect behavior and childbearing decisions.

SUGGESTED INFORMATION:

• Need is used here as being essential to a person's physical or emotional subsistence. It may be inborn, such as love or nutrition, or may be essential to self-esteem and survival in a social environment, such as respect or approval. Each person develops a value system based on needs satisfaction. If satisfaction is denied through a positive alternative, then a person may choose a negative alternative. A person develops skills to identify needs and satisfy them, and these skills influence behavior.

• Everyone needs to feel loved and valuable to others. Infants have physical needs—food, warmth—but they also need emotional care—cuddling, touching, holding. Infants have been known to die for lack of this emotional care. As infants grow into childhood, adolescence, and adulthood, they attach personal values to human interactions that provide or deny basic emotional and psychological needs (16, 17, 3).

• Examples of human needs include:

—Affection: to give and receive love and friendship

—Respect: to give and receive courtesy, admiration, recognition, and dignity

—Control: the ability to control personal behavior and some of the external factors that affect personal life

—Well-being: an inner feeling of contentment, peace, happiness, and health; escape from being sick, worried, upset or unhappy (Adequate sources to provide essential needs for food, clothing, shelter profoundly influence this sense of well-being.)

—Rectitude: knowing what is right and wrong for self; being honest, trustworthy, responsible.

• Life is a continuous see-saw between satisfying personal needs and having them denied in some way. Young people learn this daily in classroom, playground, and lunchroom situations. For example, Jimmy, not chosen for the team, responds by disrupting the game. What needs were the leaders of the game satisfying by not choosing Jimmy? How were Jimmy's needs denied or damaged? What other behaviors could substitute for satisfying each one's needs?

• During adolescence, satisfying these needs assumes a heightened sense of importance. Sexual awareness, changing roles, and self-concepts create a hunger for such reassurance as: being loved, attraction for the opposite sex, respect from peers and control over circumstances of life. For reassurance, young people often turn to sexual activity. Many adolescents deliberately seek pregnancy to have a child to love and control. They need help in finding other ways to satisfy their needs (2, 7, 27, 28).

Focus 4: Each person should realistically assess personal needs and expectations in relation to decisions about having a child.

SUGGESTED INFORMATION:

• Unrealistic expectations, a child's needs, and the parents' ability to satisfy them must be considered.

• Prospective parents should examine reasons, myths, and realities in becoming a parent. Some examples are:

—Personal/ego needs: I want to experience pregnancy, childbirth, and parenthood; to watch a child grow; to deepen a marriage relationship; to save a shaky marriage; or to have someone I can control.

—Cultural/sociological pressures: My parents want a grandchild; All my friends have a child, so I want one too; If I get pregnant, my boyfriend will marry me; It will carry on the family name; or It will fulfill my role as a woman/man.

—Psychological/sociological reasons for NOT having a child: It would interfere with my freedom; My career is more important; I don't think I would like that much or kind of responsibility; I don't like children; or Children cost money I don't have.

• Myths vs. realities:

—The desire for motherhood is instinctive, every woman wants to be a mother

—Surprise pregnancy is romantic and shows that "fate" meant it to be
—If a woman becomes pregnant, her husband will love her more
—Mothering and fathering is a serene and glorious occupation, automatically fulfilling
—Parenthood automatically makes a person wiser, more mature, and instinctive about children
—Parents and children always develop warm, companionable relationships that last for life
—To be a real family, you must have a child
—A woman must have a child in order to preserve her mental/emotional health
—Not having children causes people to become selfish, sour, and feel their lives are wasted (1, 9, 19, 22, 25, 26, 31).

For parents who cannot or choose not to have their own biological children or choose to bear only one or two children, but would like more children in their family, adoption is an alternative that can satisfy both the parents' wishes and a child's need for family relationships. Adoption agencies indicate that there is an increased acceptance by adoptive parents of children affected by birth defects or other disorders.

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Action for Local Curriculum Development

O. L. Davis, Jr.

Now, curriculum development must begin. As noted repeatedly, this booklet does not assert a curriculum. Rather, it assumes that curriculum development about responsible childbearing can only be a local enterprise. Only locally, and probably in individual schools, will teachers and others know enough about the local context, strengths, and concerns to act responsibly. In addition to this guidance, I would like to offer other guidelines for curriculum decisions.

Language and Sensitivity: Central Keys to Action

At first blush, education for responsible childbearing may appear to be either another extension of school responsibility or an irrelevant claim for curriculum attention, or both. Responsible childbearing merits more serious and sober recognition than any first blush. The personal societal costs of irresponsibility are impressive; yet, curriculum development proceeds from our perceptions of reality as much as it does from reality itself. Those perceptions of reality, as they impinge on curriculum development have to do with both responsible childbearing as well as curriculum content and goals.

Language and its use become important immediately. Our language gives form to our perceptions. Stop for a moment. Think about what came to mind when you read the phrase "responsible childbearing."

Did you think "child rearing?" Or "sex education?" Or "I can't imagine." Maybe "We have to teach about free enterprise and I don't have time to teach reading and here comes something else!" Or, "What business does the school have with regard to these goals?"

Note that our associations and perceptions have to do *both* with the concern about responsible childbearing *and* with our understanding of content and goals. Also, be aware that a not uncommon assumption is that "education for" is a plea for a new course or a new unit or module in an already crowded program.

This booklet displays reasonable care in the language used. Writers have avoided shock phrases but have not shied away from accuracy. Teachers will find the book a good model for talking about this sensitive subject. Choosing your language carefully is of utmost consideration. For example, how would you phrase a memorandum to the faculty, principals, and consultants? Can you heighten interest without scuttling possibility? What language emphasizes faculty deliberation and selection, parent involvement, and administrative support?

A second example—teachers note that the city PTA council recently endorsed systemwide efforts to concentrate time on *basic skills*. What can teachers say to parents now to enlist their support of a new course? How do you communicate that this course on responsible childbearing exhibits a concern that implies quite different goals from basic skills for young children and adolescents?

Language, of course, must be sensitivity's companion particularly with the topic of responsible childbearing. You must honor feelings, values, and contextual circumstances.

Yet, sensitivity need not suggest inaction. Recognition of the need for sensitivity suggests, instead, cautious progress.

Different schools will reflect sensitivity in different ways. In one school the curriculum study group might use careful selection to represent all groups. In another, sensitivity may show up in concern for the different values held by adults and teachers, and their sincere interest in understanding and tolerating those differences. In still another setting the adults might take modest and partial steps in presenting the new material.

Language and sensitivity must be robust and reflective. People in the curriculum process must be consciously aware of them and their cruciality.

Action: Responsibility and Anticipation, not Reaction

Since all curriculum development is imbedded in action, the nature of that action assumes major importance. Our curriculum past is littered with the hasty responses to vigorous demands for immediate attention to dramatic social problems. Last decade's curriculums to educate children and youth about drug abuse is one example. Many of these programs rushed ill-trained with little else than a visual display of drug paraphernalia and a lengthy list of harmful consequences of drug use. Over years, these separate programs have disappeared or, better, been transformed into serious programs.

We may see society react this way to dramatic and irresponsible childbearing. A climbing incidence of

childhood pregnancies is grabbing newspaper headlines and TV reports. Childhood deformity, in all its grotesqueness and personal pain, attracts widespread media attention. Inevitably society advocates that schools do something rapidly to solve the problem. Ill prepared, the schools usually react or overreact.

An alternative to reactive curriculum response is responsible attention to societal concerns. Anticipate and plan for appropriate curriculum modification and exercise responsibility in your plans.

Infusion is a proactive implementation process for local action. It requires no new curriculum pieces, courses, or units. Rather, infusion is a concept of emphasis and relationship.

Infusion assumes that the new ideas bear a close relationship to those already in the curriculum. For example, curriculums in American schools incorporate deliberate attention to concepts and topics in genetics and environmental and social influences on life. Concepts and goals of education for responsible childbearing relate closely in most cases to those familiar and comfortable elements. Their infusion, therefore, involves careful attention to these relationships. You may emphasize some concepts or topics primarily by drawing from or noting human examples and depending on the age of pupils, possible personal as well as societal consequences.

Infusion is not simply engaged though infusion requires careful attention to the present curriculum. What is being taught now in grade three, for example, about genetics? What concepts about genetics in this book relate to those currently taught? What facts and tasks can be used to increase emphasis or add another dimension to what is being taught? These are not easy questions. Their answers need additional discussion and development to avoid consequences.

This suggested infusion accepts the validity of present curriculum and the congruence between what teachers know and want to do and the proposed "new" emphases. Indeed, it builds on this congruence by urging teachers to do their own relating of ideas in their own ways in their settings. But there is a cost to infusion. The cost is not in expenditures for new materials, but in teacher time—a preciously guarded treasure.

Clearly, teachers need time for study, review of present curriculum, group meetings, and development of ideas and emphases. Infusion requires a recognition of the necessary cost in teacher time and supportive leadership for the teachers in using that time. If this cost is not properly planned for, the infusion attempt can only have marginal success.

Infusion is an effective means for including concepts and goals about responsible childbearing in school curriculums, but it imposes serious requirements on the local development process. Responsible leadership can work with teachers to convert important ideas on childbearing into appropriate, sensible topics in the current program.

Action: Mindful Awareness

Infusion, like other efforts to improve curriculum, assumes continued mindful awareness. Awareness of pos-

"You must honor feelings, values, and contextual circumstances."

"Without question, schools must not be the sole institution aware and at work on this matter."

sibilities and opportunities is crucial to the curriculum improvement process.

For example, most social studies programs teach about resource utilization and standards of living. Exploit the awareness of these facets of living. Using thoughtful questions and commentary, you may note changes over time in general health, lowered infant mortality, and even the general growth patterns of individuals in a society. Be aware of the opportunity to relate the new topic to the old.

Nutrition directly relates to the health of the mother and fetus. Specific attention to this relationship, as suggested in the booklet, need not await adolescence, or home economics and health classes. You can teach the relationship between eating and general health to quite young children. For the adolescent, you can give added attention to peer influence on eating choices. The infusion process must also relate to personal realities. The goal is for students to use the information in their own problem solving. Teachers might try open discussion as a technique in keeping touch with the reality of the individual student's world.

Another dimension of needed awareness has to do with curriculum goals that seek to reach all or most children and adolescents. Despite much effort, some youth will be missed and others will ignore or dismiss what they are taught. This topic, further, should not be assigned simply to certain curricular hexes—like science, home economics, and health. Teachers can relate the goals through other areas, such as language arts and social studies.

This content simply is not controversial. Taken out of context, program elements could be distorted, abused, and manipulated into controversial situations. That could happen in other fields also. Here, as in other situations, teachers and public can treat this content honestly and fairly.

I do have several suggestions to assist local faculties in preventing controversy. Keep the system and the public informed. Involve them in review, discussion, and decisions. As much as possible, work to ensure no surprises. Make sure concepts, materials (for example, films and booklets) and classroom instructional procedures are normal or at least widely understood. Also acknowledge the importance of these emphases and relationships in your attention to basic educational goals and processes.

In your "mindful awareness," recognize, as well, some "Is's" and "Isn'ts" of education for responsible childbearing. This program, supported by a March of Dimes Birth Defects Foundation grant, does not assert that if there is a chance of genetic defects, the mother should not have the baby. The program does *not* indoctrinate. It does offer information, suggest emphases, and insist that people understand the consequences of actions or inactions. The program does seek to aid the development of healthy people—knowledgeably healthy people. It certainly rests on the confident hope that young people, informed and capable, through their own and societal actions, can reduce defective births.

Two additional observations—responsible childbearing is not *the* responsibility of schools. As one agency, even as a convener, schools can contribute. Without question, schools must not be the sole institution aware and at work on this matter. The second—the program is *not* parent education nor is it education for parenthood. The relationships may be obvious, but the program does not depend on them for its viability.

Action: Beginning and Continuing

Accepted routines in local schools and districts may stipulate special actions and procedures. I would like to give you three additional guidelines.

First, start with strengths. A needs assessment always recognizes obstacles (another name for needs). Recognition of strengths facilitates action. For example, in this school, what is done to emphasize human genetics? To which of the concepts are we already giving attention? How much do we teachers already know about things like birth defects, about the social pressures for drug abuse, about the effects of radiation and chemicals on fertility, about local and general mores of acceptable behavior, and about the number of pregnancies in elementary and junior high schools in our community?

My second guideline differentiates curriculum construction from curriculum development. Acts, such as making decisions and establishing topics, commit only sentences to paper. Without development, the decisions rest like fallow land. The ideas and topics must become a part of teachers and their instructional plans. You must explore, test, and revise relationships. New information, fresh conflicting opinions, new principles must gain access to the curriculum documents and teacher understanding. Reflection about practice, about infusion attempts, and pupil reactions are substantial matters for the continuing development of ideas. Development emphasizes teacher involvement, activity, and purpose. Curriculum development is not a quick fix.

Third, you must plan continuity and coordination. Schoolwide infusion does not just happen. One teacher or a few colleagues can help move the program along, but they lack continuity, or, rather, pupils are confronted with fragmented and discontinued emphases. Continuity and attention to balance will not be evident immediately. Plan for continuity and coordination. As the infused program becomes institutionalized, do not lessen concern for continuity and coordination. For example, new teachers will come into the curriculum development program and need direction, and new ideas and materials that alter the system in practice must be coordinated with remaining emphases and materials.

A Note About Action

Action to ignore and to omit is still action. Such action constructs a null curriculum. It deliberately selects *out* concepts and goals. Such action has real consequences for neglect, happenstance, ignorance, and, worse, for living.

The action suggested here is the deliberate selection *into* the curriculum of concepts and goals about education for responsible childbearing. This action makes these curriculum decisions and contents both explicit and public. Consequences of this type of action are not insignificant. Whatever else, they should reflect the intentions of the action—informed people, attention to important ideas and concerns, opportunity to think and decide on the best data available, and improved lives. There is high possibility in such action.

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